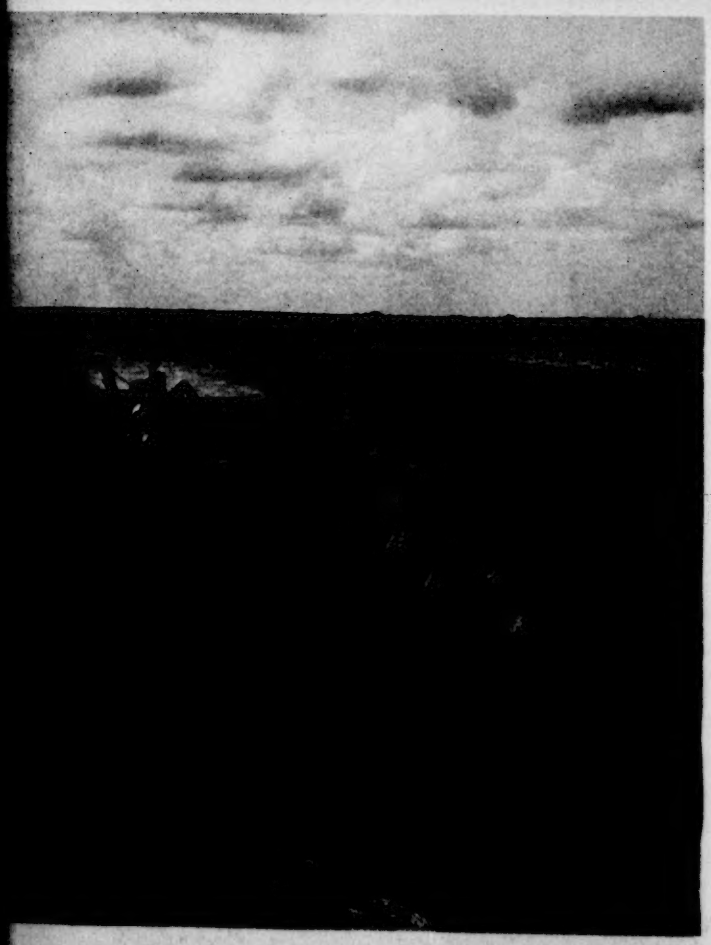

Vol. 7, No. 4 **September, 1952**

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. . . Robert M. Salter

A New Concept of Conservation
. . . Morris E. Fonda

Kentucky 31 Fescue Proves Its Value
. . . W. J. Fonville

Conservation—Everyone's Way of Life
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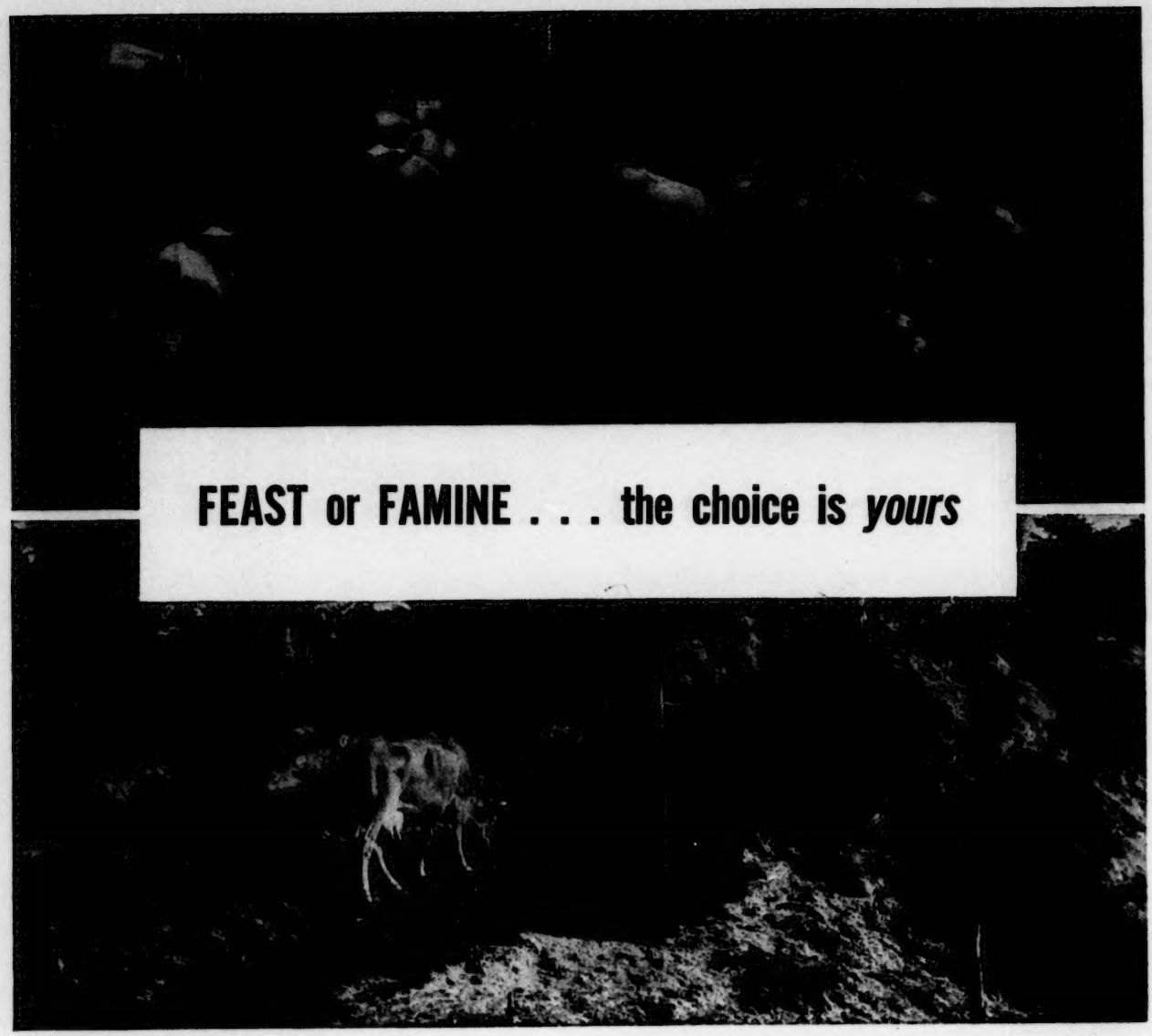

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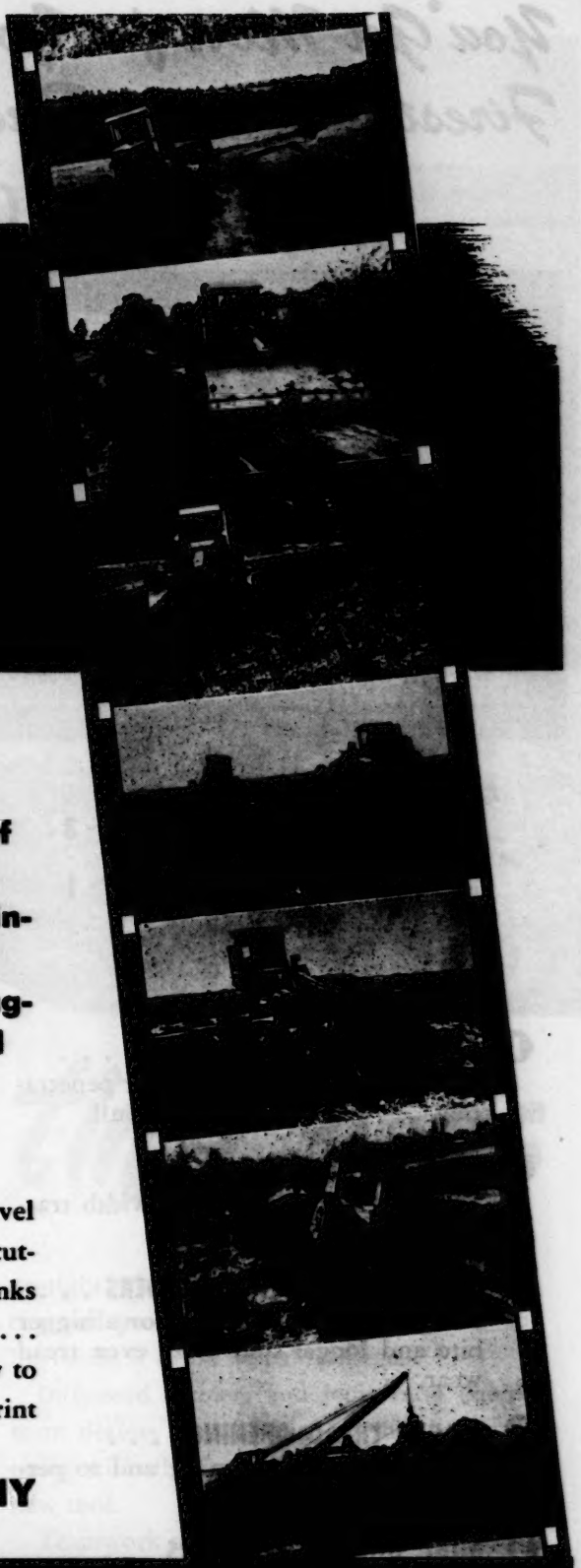

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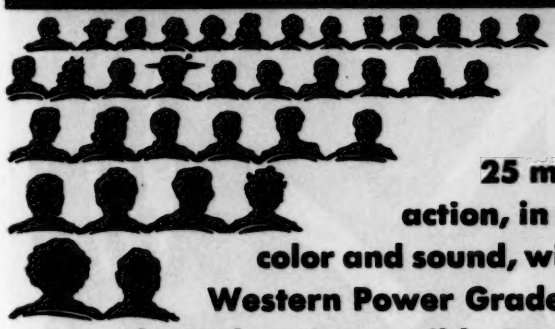

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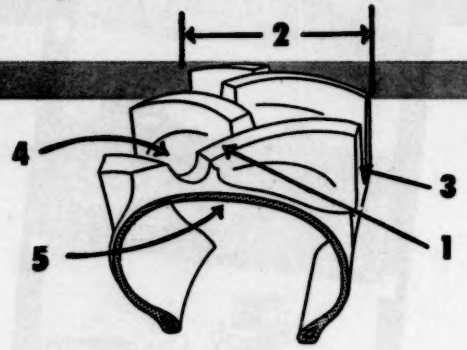

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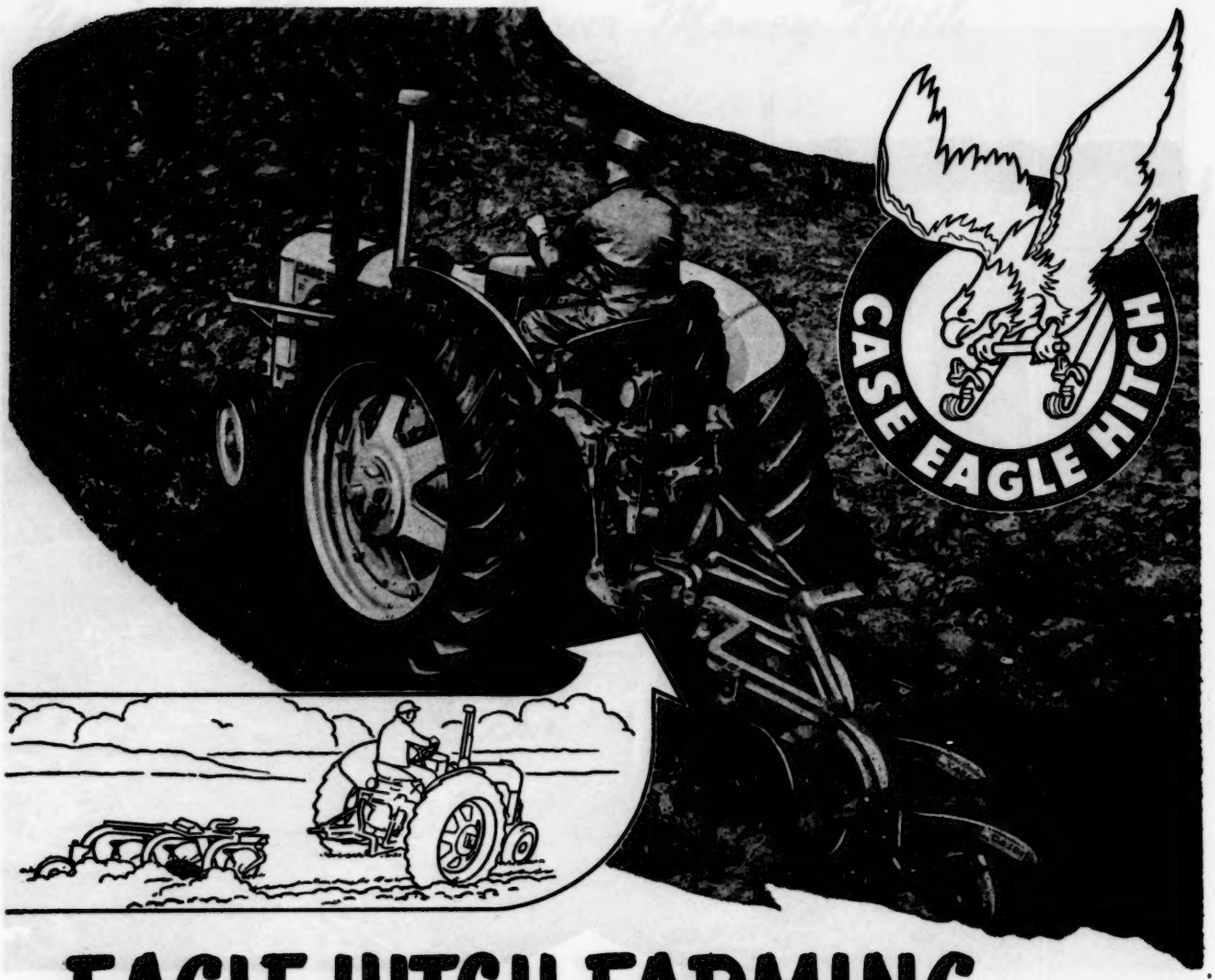

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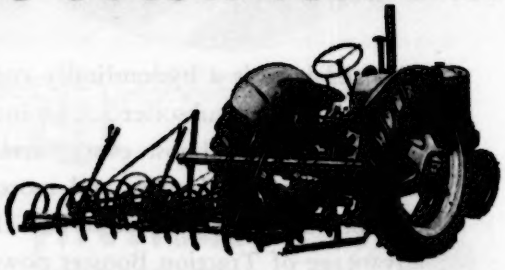

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CASE

Journal of SOIL AND WATER CONSERVATION

VOLUME 7
NUMBER 4

TO ADVANCE THE SCIENCE AND ART OF GOOD LAND USE

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Harvesting King Ranch bluestem seed at the Soil Conservation Service nursery near San Antonio, Texas. KR bluestem is an introduced grass of undetermined origin. It probably came from Asia, originally. The strain now being grown in west Texas and Oklahoma was selected from the King Ranch in south Texas. This is a drought resistant and vigorous growing strain especially suited to range land of the southern plains. Its use has spread rapidly since seeds were first released by the Soil Conservation Service at San Antonio.

Photo by Soil Conservation Service

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Grasslands in Conservation Farming

ROBERT M. SALTER

The movement toward more and better grasslands in the United States has been gaining momentum for some 15 years or longer. For several years, now, the Department of Agriculture and the State Land Grant Colleges have been promoting a coordinated program for grassland farming. The movement was given added impetus this summer when the Sixth International Grassland Congress convened at State College, Pennsylvania—the first time that the Congress has met in this country.

The grassland movement has always been tied closely to our national soil conservation program. This is natural, because it is almost impossible to do the best type of soil conservation work without using grass and legume crops extensively. Likewise, it is difficult to grow more and better grass crops without helping to conserve and improve the soil. Hence, the recent widespread interest in grassland agriculture is very encouraging to all of we soil conservationists: inevitably, we think of grassland farming as being almost synonymous with conservation farming.

THE TERM "CONSERVATION FARMING" has come to have a special meaning for most American farmers in recent years. It means much more than merely preventing runoff, erosion, and depletion of soil nutrients. The conservation farmers of today are not satisfied with just holding the line: they want to make progress forward. They are thinking in terms of making the land produce more and more, year after year, for as long as they farm it. They are trying to increase production and improve the land, both at the same time.

To do true conservation farming, you must first find out exactly what kind of land and how much water you have to work with; then you must use and treat these land and water resources in such a way that they will give the maximum production without depleting the basic resources. This treatment may involve numerous types of conservation practices. Of course, it involves using the land within its capabilities—using it in such a way that it can be protected and improved. It may also involve such varied practices as drainage, irrigation, using more lime and fertilizers, terracing, strip cropping, contouring, cover cropping, manuring, tree planting, constructing masonry and concrete structures of various types, building pond dams, constructing diversion dikes and ditches and water spreaders, and so on. But, above all, conservation farming involves the use of good grass and legume crops in rotations on cultivated fields and the protection of waterways, drainageways, and eroding lands with a good cover of vegetation.

If we use this concept of what constitutes conservation farming and what the objectives are, then it is easy to understand why the grass crops are so important to the conservation farmer.

Dr. Robert M. Salter, a member of the SCSA, is chief of the Soil Conservation Service, United States Department of Agriculture. His headquarters are in Washington, D. C.

Grass—A Basic Tool of Conservation Farmers

The grass crops are among the basic tools which conservation farmers have to work with. They are, by far, the most important tools available to most farmers for doing the soil conservation job. Their usefulness is wide and varied. A good grass cover will reduce erosion to almost an absolute minimum and will greatly reduce runoff on most lands. Grasses and legumes will improve soil structure and build up fertility in nearly all instances, if they are allowed to grow on the land for a few years. They may improve soil structure and fer-

Turning under blue lupine, as a green manure crop, in Georgia. Blue lupine was first tried and proved as a winter cover crop for the South at the Experimental Station at Quincy, Florida. It was not used extensively, however, until World War II. The large increase in peanut acreage during the war brought on acute erosion in many areas. Blue lupine proved to be a valuable soil saver and soil improver under these conditions. It is now used extensively, especially as a winter cover and a green manure crop on peanut lands of the South.

tility in one season if properly managed. Furthermore, a wise use of grass crops will increase total production for most American farms.

Grass is not a panacea or cure-all for all our land problems. A farmer who puts all his land to grass is not necessarily a conservation farmer—not unless he treats and uses the grass properly. Most conservation farmers do not plant all their land to grass. They simply use grass as it should be used to protect the land, increase water infiltration into the ground, improve the soil, bolster production, and bring about a better balanced system of farming and a higher standard of farm living.

Some of the more obvious ways in which grass is used for soil conservation are: for revegetation of eroding or abandoned croplands, for protection of waterways and gullies, for strip crops on sloping cultivated fields, as soil improving crops in rotations, and as cover crops for bare fields during seasons when erosion hazards are great. But these are not all the uses of grass in a well rounded conservation program. In fact, nearly every conservation job done involves the use of grass. For example, practically every conservation structure, whether a small baffle in a gully, a diversion dike, a drainage ditch, or a large earth dam with spillway, must be protected at some point by a sod cover. Furthermore, the proper use of grass crops will help greatly toward stabilizing the farm income, and thus, indirectly, help a farmer establish a permanent and safe system of agriculture.

Grass For Erosion Control

Most grass crops are so effective in holding soil against erosion that you can almost say that they completely prevent erosion. They are equally effective against both water and wind erosion, in most instances. For example, in a ten-year experiment at the Soil Conservation Experiment Station near Guthrie, Oklahoma, a cotton field lost nearly nine tons of soil per acre each year from sheet erosion, while a nearby field of bermuda grass lost only 0.02 tons of soil per acre. A rotated field on the Experiment Station at Bethny, Missouri, lost nearly 20 tons of soil per acre each year it was planted to corn, while losing only 0.97 tons per acre during the years it was in meadow. In the meantime, a similar field planted to corn continuously for ten years lost about 50 tons of soil per acre, each year. Similar results have been obtained at nearly all the ten soil conservation experiment stations, located in different sections of the country.

Rain, the principal agent in water erosion, is not simply a mass of water: it possesses energy. In the soil erosion process, it is the application of this energy in the form of raindrop impact that accounts for most of the dispersion of soil particles.

When falling raindrops strike the ground, most of their energy is expended instantly as work done against the soil surface. The movement of soil, caused by the impact of falling raindrops, is downward, to the sides and upward. The downward movement consumes the greater part of the kinetic energy of raindrops at the beginning of a rain. The movement to the sides and upward is caused by the spreading and splashing action of the raindrops. In a field, a large raindrop can splash soil particles 58 inches outward and 29 inches high.

The compacting action of the falling raindrops causes soil to lose its capacity to infiltrate water, despite any unsaturated condition that might exist beneath the surface. It is thus chiefly responsible for the high runoff rate during heavy rains.

Grass protects from the forces of water erosion—both raindrop impact and surface flow—by dissipating the kinetic energy of the falling raindrops and by reducing the velocity of flowing surface water. Grass acts as a springy cushion, intercepting and breaking up the falling raindrops on their way down, conducting the water down the blades and stems of the plants, and finally allowing it to reach the ground as fine spray without disturbing the soil at the surface. Grass protects against flowing surface water by reducing the speed of flow, thus preventing the water from gaining sufficient velocity to cause scouring.

Grass, if properly treated, is almost as effective against wind erosion as against water erosion. Grass plants protect the ground from wind erosion by reducing the velocity of the wind at the ground surface so that the wind no longer possesses sufficient energy to initiate soil movement. Also, the grass plants tend to trap those soil particles that have started to blow.

The effectiveness of vegetal cover in preventing wind erosion was amply demonstrated during a dust storm at Salina and McPherson, Kansas, in March 1950. Wind erosion occurred only on fields which had inadequate vegetal cover on the surface. Wherever the vegetal cover amounted to a ton or more per acre, little or no erosion occurred. On the average, about 0.85 inch of topsoil was removed from fields which had inadequate cover.

Soil Improvement

The grass crops play a major role in the development and maintenance of good soil structure. Also, they add considerable fertility to the soil if grown and managed properly, especially nitrogen in the case of legumes. These crops furnish a continuous supply of the all-important biologically active organic matter that is essential to the formation and maintenance of soil aggregates.

Samples of Marshall silt loam on which alfalfa and

This improved range, near Walnut Springs, Texas, was seeded to a mixture of little bluestem, side oats grama, and hairy grama. Nearly all the desirable species of range grasses had disappeared before the seeding was done.

bluegrass had been grown for several years at Clarinda, Iowa, had 50 to 58 percent more of the soil particles aggregated than had similar soil on which corn had been grown continuously. The improvement in aggregation still persisted after the alfalfa grass plots had been cropped to corn for three years.

Grass also appears to contribute stability to soil aggregates. At the Bethany, Missouri, Station, counts were made of the number of drops of water, falling 30 centimeters, required to disperse soil aggregates of a given size under different cropping systems. They showed, for example, that an average of only 6.2 drops dispersed the aggregates of soil that had been in continuous corn and 7.5 drops dispersed soil aggregates from 13 years of clean fallow. But it took 41.2 drops to break down the soil aggregates from second-year meadow, and 40.2 for 13-year-old alfalfa soil.

Deep-rooted legumes like kudzu and alfalfa increased the percolation rate of the entire soil profile at the Southern Piedmont Conservation Experiment Station at Watkinsville, Georgia. The volume of pores drained was several times greater for land in these crops than for that cropped annually to cotton. Similar results were recorded for northeastern Illinois soil in clover and alfalfa.

The organic matter and nitrogen content of soils is a fairly good index of productivity. Organic matter is destroyed through the activity of bacteria and other microorganisms in the soil. The process is essentially one of oxidation. Each time the soil is stirred, oxidation is increased and the rate of organic decomposition is speeded up. This explains why the destruction goes on so rapidly under corn and other intertilled crops. It is slower under small grains that require only seedbed tillage, and the slowest of all in the case of grass crops.

From studies of changes in the organic matter and nitrogen contents of long-continued crop rotation plots in Ohio, it was concluded that growing a crop of corn reduced the amount of these constituents by about two percent. The corresponding loss for a crop of small grain was about one percent. In contrast, growing a crop of clover hay increased the amount of both organic matter and nitrogen about two percent. Somewhat comparable results have been obtained from the study of plot soils in Missouri.

These analyses and experimental results clearly indicate that the growing of grass crops is usually the cheapest and easiest way to replace oxidized humus, maintain suitable soil structure, and build up potential fertility on most farm lands.

Increased Farm Production

The proper use of grass crops in conservation farming will not only protect and improve the soil, it will increase total farm production in most instances. The growing of grass crops in long-term rotations nearly always increases the total production from a field. For example, a 22-year experiment at Urbana, Ill., showed that where corn was grown continuously the yield was only 25.1 bu. per acre. On the same type of land, where grass crops were grown half the time the corn yields were 50 bu. per acre. In other words 11 crops of corn from the rotated

plot were almost equal to the 22 crops from the plot where corn was grown each year—practically all the hay and pasturage produced from the rotated plot was surplus. In addition, the soil on the rotated plot was in much better physical condition and at least twice as productive at the end of the period.

At Batesville, Ark., similar results were obtained in a rotation of cotton and grass crops. In a ten-year experiment, the plot that was planted to grass and legumes half the time actually produced more cotton in the five years it was planted to cotton than the other plot did in the ten years of cotton. Similar results have been obtained in experiments conducted all over the country.

Furthermore, by preventing loss of topsoil through erosion, grass in rotations has a significant effect in maintaining soil productivity. Studies at Fowler, Indiana, Coshocton, Ohio, Bethany, Missouri, and Shendoah and Greenfield, Iowa, have shown a constant pattern of corn yields in relation to depth of topsoil. In one such study, for instance, on 18 fields near Fowler in 1940, the corn yield on land with less than one inch of topsoil remaining was only 19.8 bushels an acre compared to 53.1 bushels where seven to eight inches of topsoil remained.

Many American farmers have had the delusion that most land will produce more if cultivated than if planted to a good grass crop. The facts are that much of the present cropland in the United States would actually produce more if it were converted to grassland. It would produce a greater amount of digestible nutrients for livestock and more pounds of beef or gallons of milk per acre. It would produce a greater net income in grass than in the so-called cash crops. This applies not only to the millions of acres of eroded and submarginal land that many farmers are trying to farm. It applies to much of the marginal land, especially to those fields that have been planted continuously to cash or grain crops for several decades.

In a North Carolina experiment, an improved pasture produced the equivalent in feed units of 87 bushels of corn per acre, on land capable of producing only 50 bushels of corn. At State College, Pennsylvania, an improved pasture produced the equivalent of 90 bushels of corn per acre on steep land that was unsuited to corn growing. At Tifton, Georgia, an improved pasture produced 569 pounds of beef per acre in one year, plus more than a ton of high quality hay.

Not only was the production per acre higher when these cultivated fields were turned into improved grasslands, the costs of production were much lower. Labor, machinery, seed, and fertilizer costs were less. For example, in the North Carolina experiments, it was calculated that the return per man hour of labor was about $23 for the pasture while less than $4 for corn and less than $6 for wheat. The New Jersey experiment station estimated, in 1951, that the cost of 100 lbs. of digestible nutrients for dairy cattle from various sources were as follows: good pasture, $1.57, grass and legume silage, $2.40, mixed hay, $3.00, and mixed feed grains, $5.60. In other words, the cheapest milk came from the pasture, while the most expensive milk was that produced by grain.

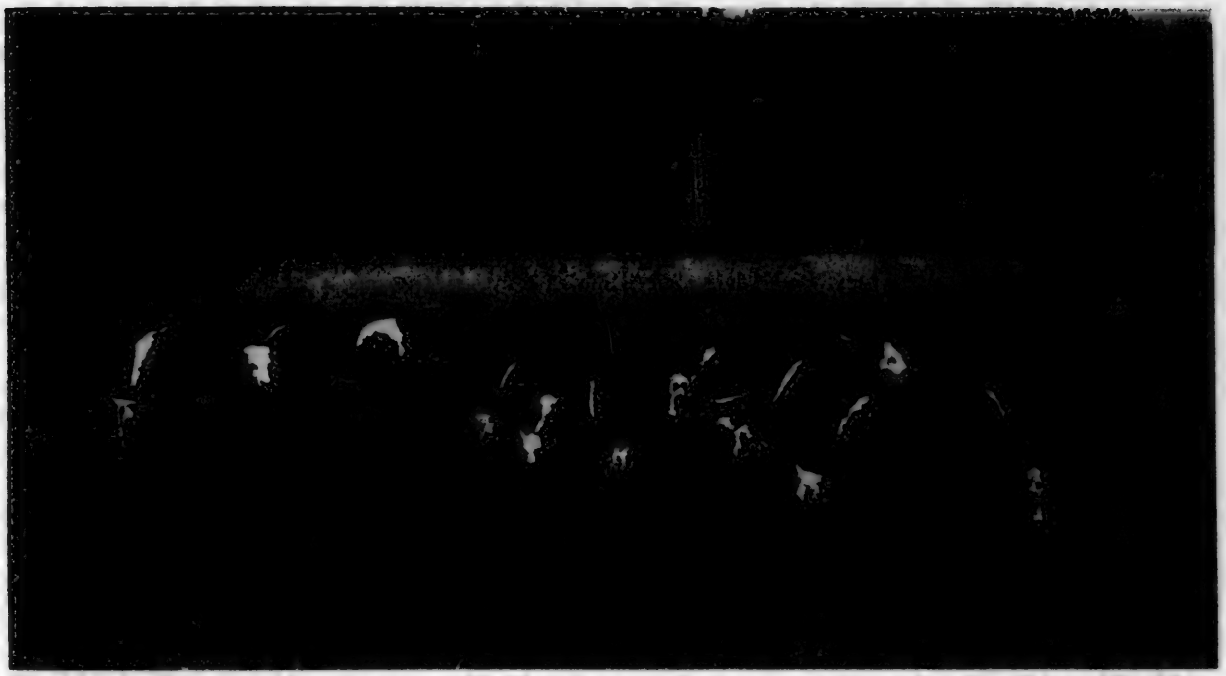
Farmers, throughout the country, have been getting similar results to the experiment stations. They have found that much of their land will produce more and will produce it at less cost if converted to improved grasslands. Paul C. Schroeder of the Anatelope Valley Soil Conservation District, in California reports that he got a net return of $112 per acre from his irrigated pasture in 1950. This profit was from grazing beef cattle on it. It was net profit after subtracting all costs, including the cost of the irrigation water. Tony Wilmer, of Huntsville, Alabama, now pastures 30 head of cattle the year round on a field that produced only three wagon loads of corn the last time he tried to grow corn on it, in 1946. Ross Perner, Jr., in the Triangle Soil Conservation District of Arizona produced 994 pounds of beef per acre from a 40-acre irrigated pasture in 1951. With beef selling at 30c a pound, that figures out almost $300 per acre gross income from the pasture.

These are just a few of the grassland farmers of the country. There are numerous others who are getting much greater production and profits from improved grasslands than they could get from raising cultivated crops on the same land. You can read stories about them in almost any issue of every popular farm magazine published.

Grass For Better Balanced Farming

Conservation farming with the use of more grass crops usually gives a better balanced farming system. This is mainly because the grass crops usually require more livestock. There are more sources of income; and the income is distributed more evenly over the year. There is less chance for complete crop failure because of the greater diversification. The labor is distributed more evenly over the seasons. And, usually less labor is required, because the livestock harvest much of the grass by grazing it.

There are disadvantages, of course, for a farmer who is just starting to expand the acreage of his grass crops. It may mean more or different kinds of farm equipment. Usually it means that some livestock must be purchased. Additional fences may be needed. Barns, silos, and other buildings may have to be expanded. Often, new water facilities may be needed for the livestock. Furthermore,



This field of tall fescue, in Virginia, was grazed by almost one animal per acre from the first of April until the middle of June, at which time the picture was taken. A seed crop was harvested from the field during July, then the pasture was grazed heavily again during the fall.

a higher quality of farm labor is often required to handle the grass crops and the livestock they support.

Altogether, the change to conservation farming and the growing of more grass crops may add up to an almost complete overhauling of the entire farming system. Yet, the change is almost always profitable, in the long run. By a wise use of grass and legume crops, you can not only increase production on both the grasslands and the croplands, but you can be assured that production will be permanent. The increases in yields will continue for all time, because the potential productivity of the soil will continue to increase.

Grass For Flood Prevention

Grass is also an important tool in our national flood control program. It has been demonstrated time and again that the amount of runoff from good grassland is much less than from cultivated fields or bare land. An experiment at Statesville, North Carolina, shows that nearly 30 percent of all the rainfall ran off a bare field and about 11 percent ran off a field of cotton, while less than two percent of the total rainfall ran off similar land that had a good grass cover. Similar results have been obtained at numerous other experiment stations. Furthermore, the amount of mud contained in the water from grassland is almost negligible, while huge amounts are in the flood waters that come from bare or clean tilled fields. The mud in such water greatly increases the total amount of flood water and tends to slow down the flow.

The Soil Conservation Service and cooperating soil conservation districts and farmers are using grass extensively in watershed treatment for flood prevention. For example, in the Upper Washita Soil Conservation District of Western Oklahoma more than 10,000 acres of eroding cropland, bare range, and idle land were planted to native grasses (principally the bluestems, grama grasses, and sand lovegrass) in 1951 alone as a part of the flood prevention program. More than 2½ million Kudzu crowns were planted in 1951 in the Tallahatchie river watershed of Mississippi as a part of a like flood prevention program. Grass is being used extensively in every other area where the Service is cooperating with soil conservation districts and farmers under provisions of the Nation's flood control program.

Good Grass Crops vs. Poor Grass Crops

Nearly 60 percent of all the land in the United States, over a billion acres, is used for grazing or hay. This includes some 660 million acres of range and permanent open pasture, about 345 million acres of woodland and forest pasture, 75 million acres of hay land, and nearly 50 million acres of cropland used for pasture during a part of each year. Only a small percentage of this land is now producing the excellent hay and pasture crops of which it is capable. Furthermore, there are about 70

million acres of idle land in the southeastern States that could, and should, be converted to grassland.

The difference between good grasslands and poor grasslands may be phenomenal. Poor grassland may produce such a small amount of forage that it is hardly worth grazing. The grass cover may be so poor that it will not even protect the land against serious erosion. Gully erosion has despoiled hundreds of thousands of acres of poor grassland in the eastern half of the United States, while wind erosion and gullying have damaged millions of acres of range land in the western part of the country.

Most of the grassland of this country would produce from two to ten times as much forage as it is now producing, if improved according to knowledge we now have. Most grassland should be reseeded to better species of grass or grass and legume mixtures. Nearly all the grassland east of the Great Plains should be fertilized regularly; so should most of the irrigated grassland of the west. Large areas of grassland in the east and on the west coast should be properly drained. Lime is needed on most grassland east of the Mississippi. Weed and brush control are needed on most pastures and ranges. Irrigation would be profitable for more of the western grassland, where water is available; and more frequent irrigation would be profitable on most of that which is irrigated. Supplemental irrigation would pay on much of the grassland in the eastern part of the country. Improved grazing methods would pay, on probably, 90 percent of all pastures and ranges.

Some Examples of Good Grassland Farmers

Let's look at what some of the better grassland farmers are doing toward improving their pastures and meadows, through planting of improved species and varieties, fertilizing, irrigating, and using better grazing practices. Tom Folsom, near Monticello, Florida, has a 16-acre pasture that he planted to Pensacola Bahia grass in the spring of 1948. He top-seeded it to reseeding crimson clover in the fall of that year. Since that time he has fertilized and limed regularly. He has kept down most of the weeds by mowing. During the spring and early summer of 1952 he grazed 33 head of cattle on the 16 acres, but the grazing cattle were not keeping up with the grass growth: seed stalks were beginning to develop. On July 16 he decided to harvest a seed crop from part of the pasture. For 13 days he confined the 33 head of cattle to four acres, while the other 12 acres were maturing a seed crop. He harvested 2,700 pounds of seed, and still has an excellent pasture for the remainer of the grazing season.

J. P. Sasser of Clopton, Tennessee, has converted a 154-acre worn out cotton farm to an excellent grassland farm in four years. Whereas the farm raised little of anything except cotton and gullies, and not too much cotton, in 1947, it now raises only 25 acres of cotton each year and no field is planted to cotton oftener than every second or third year. Practically all the rest of the farm is grassland. There are about 60 acres of permanent improved pasture on the farm and at least 45 acres of rotation or winter pasture each year. He carries 76 head of cattle on the grassland and in 1950 bought no feed for the herd. He has pasture almost the year round and has plenty of good hay when pasture is not available.

The Pierson and Ovenall ranch in Skagit county, Washington, has 300 acres of improved grassland that was developed from former forest and brush land. The improvement measures consisted mainly of clearing, seeding to a good mixture of grasses and legumes, fertilizing, and rotation grazing. In 1951 the 300 acres furnished excellent grazing for 300 head of cattle from early spring to fall, and, in addition, made 100 tons of hay and 150 tons of silage.

It is a common practice among many dairy farmers of the Pacific coast to keep their land in grass for five to seven years, then plow up the grass and plant grain for one or two years, after which the land is again put to grass. They find that this long-range rotation pays. They maintain better pastures this way, and the grain always yields bumper crops. These Conservation farmers with their improved irrigated pastures normally use the equivalent of 300 pounds of Ammonium Nitrate or 600 pounds of Nitrate of Soda per acre on their pastures each year. The fertilizer is usually applied in three equal parts. They also apply phosphate fertilizer, but usually it is applied only once a year, in the fall.

Rotation grazing really comes into its own on the irrigated pastures of the Pacific Coast States. A common practice is to divide pastures into three or four fields and graze each in turn. Each pasture is grazed for five to ten days and rested for 15 to 20 days. Pastures are irrigated twice between each grazing period, once right after the stock are taken off and again about three days before the stock are put back on. Usually a pasture is mowed and droppings scattered right after the stock are removed. Some dairymen use movable electric fences and move their cows to a fresh pasture each day.

In Tillamook County, Oregon, many dairy farmers have found it pays to use sprinkler irrigation in spite of the 90 inches annual rainfall. Most of the rain falls during the winter and early spring. The summers and early fall are dry. Hence, these farmers construct drainage ditches on their level land to handle the excess rain, and install sprinkler irrigation to supplement the rain during the dry months. This way, they have good pas-

Shorthorn cattle graze part of the luxuriant growth of brome grass in a waterway on an Iowa farm.

tures for six to eight months each year. Of course, they fertilize heavily and practice rotation grazing on these good pastures, and they have them planted to the best mixtures of grass and legumes they can find.

B. W. Householder of the Coastal Soil Conservation District in Georgia reports that he has been averaging more than 400 pounds of beef per acre each year from an improved pasture of tall fescue, coastal bermuda, and ladino clover. R. B. Wenger of Harrison county, Mississippi, reports that in four years he harvested 12,900 pounds of Bahia grass seed and 225 tons of hay from a 12-acre plot. He spent $1,634 for fertilizers for the plot, but the hay was worth $5,625 and he sold $11,490 worth of seed.

These are but a few examples of what conservation-minded farmers are doing in various sections of the country; but they illustrate what can be done toward improving our grasslands and increasing farm income through the use of more and better grass crops.

Some Regional Problems and Solutions

In our northeastern states, grass always has played a major agricultural role. Dairying is of great importance, and farmers try to raise their own hay and pasture. During the last few years much progress has been made in improving both ground cover and animal forage through the wide use of tall-growing grasses and legumes to replace the lower-growing strains. Ladino clover, for example, is rapidly replacing White Dutch clover; and orchard grass, brome-grass and timothy are replacing the bluegrasses on highly improved pastures. Birdsfoot trefoil has found an important place for both hay and pasture on soils unadapted to alfalfa or the clovers.

Generally this has been a region of grass-based rotations, with the exception of some intensively farmed truck crop lands. Even on those lands, research by the Soil Conservation Service and the New Jersey State Experiment Station has shown that putting truck crop land to grass one year out of four not only maintained production as compared to continuous truck crops but in some cases, such as in growing sweet corn, actually increased production.

In the central states, corn has been the most important cultivated crop since the land was originally cleared. Soybean production has expanded in recent years. Livestock in this so-called Corn Belt consisted principally of feeder steers brought in each fall from ranges farther west, and hogs produced on the farms locally. Corn continues to be the main source of feed in this area, and the acreages of hay and pasture still are not sufficiently large to allow the full use of forage crops in rotations. Erosion, loss of soil organic matter, and accelerated deterioration of soil structure have been widespread; and losses from drought and floods have increased because of impaired capacity of the soils to absorb and hold water.

During recent years in this area there has been a great expansion of alfalfa, usually planted with bromegrass. Research has developed improved varieties of alfalfa, red clover and bromegrasses that are better adapted to the different soils and climate, as well as being resistant to diseases affecting older varieties. Renovation of short-

grass pastures to include the tall legumes and grasses likewise has been of major importance.

The most phenomenal advances in grassland farming and soil conservation, however, have been in the southeastern States. This great agricultural area was often called, in times past, "The Cotton and Tobacco South." Cotton and tobacco are still important cash crops to the region; but they are no longer considered the most important crops by the conservation farmers of the area. Tens of millions of acres of improved grasslands have been established in these States during the last decade. Millions more are being developed each year. There is still several times as much unimproved grassland, idle land, and eroding cropland needing to be converted to improved grassland as there is good grassland. If the present trend continues, however, it should be no more than two or three decades until the agriculture of this abused region will be on a stable basis, with grasses and legumes playing the major role in the rejuvenation.

Farther west in the Great Plains states, we have both serious wind and water erosion problems. Vegetation is necessary to cover the lands during critical periods of high wind velocities. The Soil Conservation Service pioneered in developing cultural techniques for growing crops under a mulch farming system. To increase available soil organic matter and nitrogen, attention has been given to winter legumes such as the vetches. In Nebraska, Texas, and Oklahoma, for example, the acreages planted to vetch have greatly increased in the last few years. The Nebraska Crop Improvement Association has certified a new vetch variety, Madison, that is being produced for use in that state's sandy land areas.

Experiments are being conducted in other parts of the Great Plains to determine the value of grass in long rotations with wheat and grain sorghums. All this work is pointing toward the greater uses of grasses and legumes to maintain the productiveness of crop land while conserving the water resources and controlling the violent action of spring winds.

The most extensive area of grassland in the United States, more than 700 million acres, is found in the 17 states comprising the American West. These are the arid and semi-arid grasslands that are the range country. The close relationship of grass, soil, and water was not fully appreciated by the early settlers, who saw the grassland as an inexhaustible resource, awaiting only the plow or herds of livestock. Its importance was not fully recognized, in fact, until the pressure of too many animals brought about drastic changes in the grassland itself. In many parts of the Great Plains, for example, the taller grasses were replaced by less productive short grasses that are better able to withstand heavy use. In California, the character of the entire grassland flora changed over hundreds of square miles, from native bunch-grasses to weedy annuals, many of them introduced from the Mediterranean region. The native legumes have largely disappeared from most of these natural grasslands, and shrubs and other woody vegetation have spread over millions of acres. These changes almost invariably have resulted in a type of vegetation less able to conserve moisture or withstand erosion. As a consequence, gullies have appeared in many areas and these, in turn, drain away much of the rainfall formerly availble to support a more luxuriant plant growth. Furthermore, more than 20 millions of acres of these natural grasslands have been unwisely put to cultivation. These are lands where the hazards of a semi-arid climate, steep slopes, and poor soils are too great to permit their sustained use for cultivated crops.

Remarkable success has been attained in the improvement of depleted natural grasslands by reseeding. Approximately 15 million acres were successfully reseeded through private and public efforts in the past decade. Among the introduced grasses, crested wheatgrass has been most widely used for this purpose, but an increasing list of others are proving valuable. These include intermediate wheatgrass, King Ranch bluestem, a number of the lovegrasses, Russian wildrye, and others.

An important development in our seeding experience is the growing appreciation of the best native species for this purpose. Far greater use is now being made of them than was the case only a few years ago. This development is due in part to increasing evidence that certain of the introduced species will not maintain their production indefinitely in competition with the aggressive natives.

The two principal advantages of reseeding depleted range lands are the immediate protection the added cover affords the soil, and the increased forage production, which may be several times that of adjoining unseeded native range.

When the conservation movement started in the United States and the importance of grass became so obvious, we were confronted with the task of obtaining seed for planting hundreds of thousands of acres. Many of the areas that needed regrassing were adapted only to native grasses. These grasses never had been harvested for seed on a commercial basis before, however, and no seed could be purchased from farmers or commercial seed companies.

Technicians of the nursery division of the Soil Conservation Service helped develop the necessary techniques for harvesting native grass seed, and for processing it so it could be seeded through available drills. Many types of standard grain drills were tried with various modifica-

(*Continued on page* 198)

A New Concept of Conservation

MORRIS E. FONDA

As citizens, we cannot comprehend the scope of the conservation problem and need unless we appreciate what it is—and what it means to our industrial, business, social and educational development. This new conservation concept is a challenge to everyone, a challenge to get across the conservation picture in its entirety.

IT DOES NOT SEEM TOO LONG AGO since I flattened my nose against an airplane window, while winging across the midwest, to try and see how many farms I could pick out that had evidence of terracing or strip cropping. And if I happened to be traveling with a fellow conservationist when we spotted these practices, we would usually exclaim, "*there is a conservation farmer.*" Other farms, that lacked the winding strips or telltale terrace ridges, simply belonged to the large group of nonconservation farms that were quite evident from an altitude of several thousand feet. We measured conservation largely by the appearance of two or three outwardly apparent conservation practices.

While I am reminiscing, memories from the early days of the Civilian Conservation Corps also bring to mind concepts of conservation that were prevalent some twenty years ago. Much work with farm people during these days included almost entirely the construction of gully check dams and the planting of trees in the gullied areas. Our CCC camp boasted a yearly average of over a million trees planted each year. That was conservation . . . to us and to the farm people in that part of the nation, even though much of the good land in that area was rapidly deteriorating or eroding away.

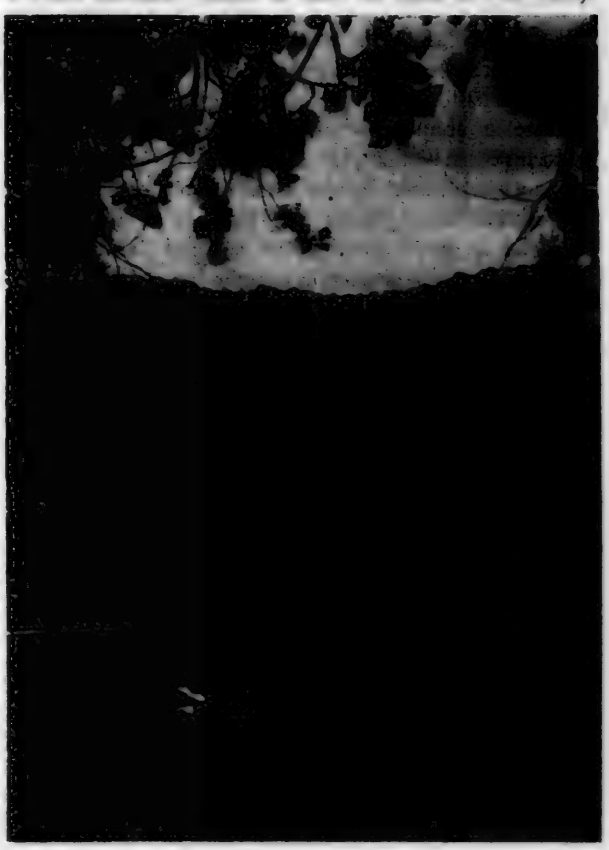
Not long after this gully plugging era, I had occasion to work in another location where the farmers believed their soil conservation problems could all be solved by terracing their land. Therein followed an intensive program of terracing—by contractor and farmer. I had occasion to see some of this land not long ago, and much of it had either been abandoned, or was being replanned for trees and pasture areas. Many farmers in this locality learned through tragic experience that the single practice of terracing was not the answer.

These experiences occurred many years ago . . . at the start of the so-called "action period of conservation." During the last two years, my wife and I have visited several chapters of the Society, and attended many field trips, in the west, middle west, southwest, south, southeast, east, and northeast. One of our early stops was in Salt Lake City, where a good friend from the Forest Service gave us a real picture of the work that agency is doing on nearby Davis watershed. We heard about soil and water conservation and the effects of good conservation practices on watershed control. We saw the results of vegetative practices, and large contour furrows built on mountain slopes. We listened to the story of controlled grazing.

One Practice is not Enough

The conservation picture was as complex as the land . . . but the attack was complete and thorough and every facet of soil and water conservation had been duly considered. Later the Soil Conservation Service technicians gave us a good glimpse of the work the local soil conservation district is doing in the Salt Lake area . . . of their problems of drainage in one section and irrigation

Even level land requires conservation and this sod crop not only helps improve tilth and increases organic material—it is a sound economic venture as these fat cattle so well testify.



Morris E. Fonda is President of the Soil Conservation Society of America. He is also associated with Harry Ferguson, Inc., with headquarters in Detroit, Michigan.

Land and water use is basic to any program as is clearly indicated on these rolling acres. Woodland, pasture and meadow, and cropland all find their proper place under complete conservation.

in another; of the work in grasses which will prosper under adverse conditions.

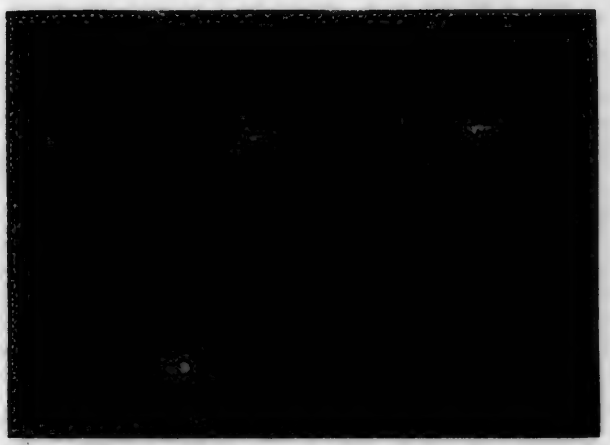
While in California, we learned of an example of complete conservation on stockman Dave Barnett's ranch. Thirty inches of rainfall is not enough to make the land produce as abundantly as stockman Barnett wants it to, so his conservation plan includes a 125 acre-foot dam that supplies water for 30 acres of improved pasture. In addition, such grasses and legumes as Dallisgrass, perennial ryegrass, birdsfoot trefoil, and Ladino clover are used to help develop maximum pastures too, and these practices, along with controlled grazing, all go to help make complete conservation a reality on the Barnett acres. No one practice or "one shot effort" is enough.

Near Trinidad, Colorado, Lawrence Boyd changed a minus to a plus on his 4,200-acre ranch with complete conservation tailored to all of his land needs. Overgrazing by sheep and goats was corrected by controlled grazing, gullies were checked and the water spread over the grass, stock ponds help distribute the livestock and make better use of grass, 55 acres are under irrigation and more planned, the ponds are stocked with fish, and deer and wild turkey are again appearing in the area. The problems on the Boyd ranch were recognized in their entirety and the plan developed with his soil conservation district used all necessary measures to correct these problems.

It had been some years since I had taken a good look in the blue grass state of Kentucky and I am afraid the memory of my last trip some 12 years ago reflected too many examples of land deterioration and misuse. But during our travels last year, we crossed the state in two locations and I was pleasantly surprised to see the fat cattle, lush pastures, and acres and acres of good hay crops. Dick Stark's farm in Woodford County, Kentucky offers further proof that we have emerged from the knee pants stage of conservation. Dick has successfully integrated legumes and grasses into his rotation, renovated his pastures, developed a program of grass silage for better utilization of forage, increased his cow herd and other livestock and put his tobacco on the contour. This has all added up to a better farm income while his land is not only being held in place, but built up in fertility.

Until last fall I had never been in the good state of Florida. We drove down the west coast, cut across the Everglades section and returned up the east side of the state. In the Everglades section we often observed half-starved cattle with their ribs sticking out like the limbs from a dead tree. When we did see good fat cattle, I was quick to point out that I would wager there was a conservation farmer. To me it was as evident as the strip cropped fields I had observed from an airplane window.

Ample proof of conservation farming in the Everglades is found on Mr. M. A. Drake's farm in Hendry County. One of the first practices in the conservation plan he installed was an irrigation system that also acted as a drainage system. Mr. Drake sowed Bahia, Pangola,



This air photo is an indication ot conservation—but not necessarily complete conservation. Today we know much more is usually needed than one apparent practice—starting with basic land and water use and working right up through the needed conservation measures.

Costal Bermuda, Para, and other grasses. His animals became sleek and fat while other farmers bought feed by the carload. Land that had been bought by Mr. Drake for $22.00 an acre, recently sold for $210.00 an acre, because conservation came to the Everglades.

Up in the northeast, the Wethersfield Farm in famous Duchess County, N. Y., portrays modern conservation at its best. Over 150 acres have been reforested to add to the already 200 acres of woodland. One hundred cords of firewood come from the woods annually and a wood chipper converts waste products to bedding for cattle and poultry. Farm ponds provide water not only for the 110 pure bred Guernseys, but also gives water for crop and pasture irrigation. Grasses and legumes, along with good soil treatment, are building up fertility while supplying grass silage, hay and pasture. Again, conservation has been used according to the complete needs of the land.

At the recent Sixth International Grassland Congress held at State College, Pa., paper after paper representing almost every part of the globe, stressed again and again the importance of vegetation in soil holding and building . . . and its effect upon the economic welfare of people and communities. From Africa, Australia, South America, the United States, and other countries came evidence that the proper use of vegetation in conservation farming resulted in greater moisture infiltration and better water control in drainage areas or catchments. In fact, it is becoming more and more apparent that increased development in the field of water use is as important as land use, and perhaps is a new era of opportunity offering a real challenge to conservationists.

As readers of the Journal know so well, example after example could be added to the above illustrations to show the multitude of conservation segments that when placed together make up the whole. The trails of early conservation now encompass many highways since the days when conservation farming was too often determined by the strip cropping which flowed beneath the airplane. Today we realize that true conservation means an integration of uses and measures to physically hold the soil intact . . . and of equal importance to increase the productivity of the land. It also means the planning and application of the proper use of water, from the standpoint of water holding, the removal of excess water where it should be removed and the application of water on certain areas through irrigation and similar methods. Usually this concept of conservation requires many uses and practices which reach right down to the economic welfare of the farmer and the community.

An understanding of this concept is important to every American. As citizens, we simply cannot comprehend the scope of the conservation problems and needs unless we appreciate what it is—and what it means. If we are in business, or industry, we cannot bring to bear, for the benefit of conservation, the full efforts of our services and products unless there is a proper knowlege of land use. In social, educational, and public work, an understanding of complete conservation is a must if these segments of our society are going to be of maximum value in abetting the cause of conservation.

This new era of understanding is a challenge to every conservationist—a challenge to get across the conservation picture in its entirety to all of those with whom we come in contact. It has been my experience that few people, other than agricultural workers and conservationists, understand the meaning of conservation. When this understanding is more fully reached by the public at large, we who are interested in conservation will see more of our efforts and resources directed to getting the total job done . . . and the job of good land and water use will become a reality on our landscape.

"The well being of our nation is dependent upon the continued productivity of the land, since the products which fulfill man's basic needs originate from the soil. Livestock farming is the natural way to maintain soil fertility. Grasses and legumes, which are an essential part of soil conservation, are practical and profitable only because they can be marketed through livestock."
THOS. E. WILSON, *Chairman of the Board, Wilson & Co., Inc.*

Some Limitation on the Use of Succulents For Erosion Control

D. M. ILCH

Why not use succulents? This question is often asked in the perennial search for the ideal erosion-control plant. Oddly enough, little appears in the literature to indicate that any consideration has been given to the apparently promising succulents, a cultural group consisting of fleshy plants of many kinds. This aggregation of plants is comprised of genera and species of several families. In their wild forms, succulents are native to widely separated geographical areas, for the most part being indigenous to the arid or semiarid regions of Asia, Africa, North and South America, and the West Indies.

A NUMBER OF ARTICLES in various botanical journals have described carefully the taxonomic characteristics of individual species. Discussions of their use have emphasized the value of succulents as garden ornamentals. Yet the plants have had erosion-control use. For many years, home owners and gardeners have planted at least two of the most common species found on the southern California coast—the local ice-plant (*Mesembryanthemum crystallinum*) and the sea-fig (*M. chilense*)—to cover raw exposed cut-banks or terraced garden slopes, and as a general-purpose ground cover. A third species, also called ice-plant or Hottentot fig (*M. edule*), has been planted by the California State Division of Highways for more than twenty years on cut-banks along the right-of-way to reduce bank erosion. The State Division of Highways found that this species tended to die out or become unthrifty after several years, presumably because of low soil fertility; further, that the use of the species should be restricted to the milder sections where the temperature never falls below 25 degrees F., and to that point only for short periods.

In 1928 the Forest Service became interested in succulents as a potential fire-resistant plant for use on firebreaks in the southern California mountains. Test plantings of *Mesembryanthemum roseum* and *Mesembryanthemum edule* were made in small plots on a firebreak at the Devil Canyon Nursery, situated at about 2,800 feet elevation in the San Bernardino Mountains. Unfortunately these succulents proved too appetizing to deer and rabbits who consumed the plants almost as soon as they were planted. The next year two species of *Euphorbia* were selected for trial, largely because of their unpalatable milky juice. Cuttings of the two species chosen, *Euphorbia laro* and *Euphorbia mauritanica* were tried both in the nursery and in the field but without success. They failed to withstand temperatures below 25 degrees F. and 22 degrees F. respectively.

A few years later the Los Angeles County Forestry Department tested various species of *Mesembryanthemum* at their Henninger Flats Nursery in the San Gabriel Mountains. Again the plants were either destroyed by deer and rabbits or killed by low temperatures.

Activation of the Civilian Conservation Corps in the middle 1930's brought an upsurge of new firebreak clear-

Figure 1.—Fenced plot used in trial planting of succulents on cleared firebreaks. Climatic station in foreground (San Dimas Experimental Forest, California).

D. M. Ilch is associated with the California Forest and Range Experiment Station with headquarters at Berkley, California.

Figure 2.—Eight months' growth of *Mesembryanthemum croceum* cuttings planted in firebreak plots.

ing in most of the southern California forests. More than 2,500 miles of firebreak had been constructed by 1936, each requiring costly recurrent maintenance. These new clearings were also opening up new sources of erosion. As great gains might be realized from the successful establishment of succulents on firebreaks, further investigation was justified. A study was begun in 1936 under the direction of C. J. Kraebel, principal silviculturist, California Forest and Range Experiment Station, with the objective of selecting and field testing various succulent species for firebreak planting.

Ecologically, the plant qualities required to meet the demands of this project were extremely severe. In order to facilitate selection of species for trial, the following criteria, in order of importance, were used:

1. Low inflammability; quick recovery after fire.
2. High frost resistance; endure at least 18 degrees F.
3. Good drought resistance.
4. Thrift; that is, should grow strongly in poor soil.
5. Prostrate habit; should make a dense or matted growth.
6. Reproduce naturally by seed or otherwise.
7. Root readily at nodes.
8. Aggressiveness; should be able to maintain itself against invasion of native vegetation, especially the highly inflammable annuals.
9. Soil binding ability.
10. Nonpoisonous to humans.
11. Unpalatable to deer and rodents.
12. Nonthorny.
13. Available in large quantities.
14. Reasonable in cost (seed or plants).
15. Easily transplanted.

Thirty-five species of succulents were considered and the seventeen most promising were evaluated on each of these criteria. Each species was rated as very good, good, fair, and poor on the basis of information obtained from numerous specialists and nurserymen (table 1).

Only eight species of succulents were selected for testing from the thirty-five species considered. Tests were made on six plots, each 200 feet long and 44 feet wide, selected on cleared firebreaks on the San Dimas Experimental Forest in the San Gabriel Mountains, to represent a range in elevation, aspect, gradient, and soil, as follows:

Plot No.	*Elevation*	*Aspect*	*Slope %*	*Soil*
1	1,700	W	65	Sandy loam, shallow, rocky
2	2,800	SSW	10	Heavy loam, deep
3	3,000	S	32	Sandy loam, shallow, rocky
4	2,550	W	30	Shale, rocky, shallow
5	2,700	SE	28	Light, rocky, shallow
6	5,050	SE	3	Light, rocky, shallow

Table 1. Preliminary Rating of Succulent Species for Firebreak Planting (VG, very good; G, good; F, fair; P, poor)

Species	Numbered criteria														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mesembryanthemum croceum[1]	VG	?	VG	VG	VG	VG	VG	VG	VG	VG	P	VG	VG	VG	VG
Euphorbia biglandulosa	F	?	VG	VG	VG	VG	P	VG	VG	?	VG	VG	P	P	G
Euphorbia tirucallii	F	?	VG	VG	VG	VG	P	VG	VG	?	VG	VG	F	F	G
Euphorbia mauritanica	F	?	VG	VG	VG	VG	P	VG	VG	?	VG	VG	F	F	G
Mesembryanthemum tenuifolium	F	?	G	VG	VG	?	G	VG	VG	VG	P	VG	F	F	VG
Mesembryanthemum coccineum	F	?	G	VG	VG	?	G	VG	VG	VG	P	VG	F	F	VG
Mesembryanthemum verraculatum	G	?	G	VG	VG	G	F	G	VG	VG	P	VG	F	F	VG
Stomatium agninum	G	?	VG	VG	G	G	F	G	G	VG	F	VG	F	F	VG
Mesembryanthemum roseum[2]	F	G	F	VG	VG	G	VG	VG	VG	VG	P	VG	VG	VG	VG
Mesembryanthemum edule[3]	F	G	G	VG	G	F	G	F	G	VG	P	VG	VG	VG	VG
Mesembryanthemum chilense[4]	F	G	G	VG	G	F	G	F	G	VG	P	VG	VG	VG	VG
Aridaria bijlea	F	?	G	VG	VG	VG	P	G	G	VG	P	VG	F	F	VG
Aridaria pentagona	F	?	G	VG	VG	VG	P	G	G	VG	P	VG	P	P	VG
Mesembryanthemum lehmannii[5]	G	?	G	VG	VG	F	P	VG	G	VG	G	VG	F	F	VG
Mesembryanthemum echinum[6]	G	?	F	VG	VG	P	P	G	G	VG	P	VG	P	P	VG
Delosperma subincanum	G	?	F	VG	VG	P	P	G	G	VG	P	VG	P	P	VG
Erepsia heteropetala	?	?	F	VG	VG	?	?	VG	G	VG	P	VG	P	P	?

Species also known as: [1]Hymenocyclis croceum; [2] Drosanthemum floribundum; [3]Carpobrotus edulis; [4]Carpobrotus aequilaterale; [5]Corpuscularia lehmannii; [6]Delosperma echinatum.

Table 2. Survival of Succulents in Firebreak Test Plantings

Species		Percent survival at 1,700 ft. elev. Oct. 1936	Feb. 1937	Aug. 1937	2,500 ft. elev. Oct. 1936	Feb. 1937	Aug. 1937	2,700 ft. elev. Oct. 1936	Feb. 1937	Aug. 1937	2,800 ft. elev. Oct. 1936	Feb. 1937	Aug. 1937	3,000 ft. elev. Oct. 1936	Feb. 1937	Aug. 1937	5,000 ft. elev. Oct. 1936	Feb. 1937	Aug. 1937
M. roseum	Apr. 36	68	4	0	90	1	1	86	86	0	97	0	0	93	0	0	1	0	0
M. tenuifolium	"	58	3	0	73	0	0	64	50	0	66	0	0	51	0	0	5	0	0
M. croceum	"	0	0	0	70	50	22	91	75	2	0	0	0	0	0	0	12	0	0
M. lehmannii	"	10	3	0	67	0	0	45	40	0	6	0	0	0	0	0	1	0	0
M. edule	"	81	20	0	98	0	0	94	0	0	62	0	0	96	10	2	24	0	0
M. chilense	"	No test			64	0	0	No test			No test			No test			No test		
Storatium agninum	"	38	8	0	No test			No test			No test			No test			No test		
Euphorbia mauritanica	"	No test			3	1	0	No test			No test			No test			No test		
Max. temp. July '36		118 degrees F.			117 degrees F.			118 degrees F.			115 degrees F.			115 degrees F.			120 degrees F.		
Min. temp. Jan. '37		19 degrees F.			22 degrees F.			11 degrees F.			16 degrees F.			20 degrees F.			14 degrees F.		

Each plot was fenced to exclude deer and rabbits. Two maximum-minimum thermometers were installed at each plot, one at each end. The thermometers, Taylor type-sixes, were attached to low supports protected on three sides and the top from the direct rays of the sun. The bottom of the thermometer was positioned six inches from the ground.

Rooted cuttings of the species selected were planted in blocks of 200 each. Time of planting was delayed until April to permit establishment of the plantations before the winter season when killing frosts might be expected.

Figure 3.—Eight months after planting this *Mesembryanthemum* roseum grew from a single cutting to cover an area of about 26 x 20 inches.

Survival of the species tested (table 2) was uniformly poor at plot No. 6, 5,000 feet elevation. Average survival of all plants dropped to about 20 percent at this elevation during the first three months after planting. By December, practically all plants had died, long before the critical, low temperatures were experienced.

On the remaining five plots, three species, *Mesembryanthemum roseum, Mesembryanthemum tenuifolium,* and *Mesembryanthemum edule,* maintained a uniformly high survival throughout the first hot, dry summer season. Rate of growth and spread of plant cover were generally good during the summer period for these same three succulents, which developed from single-stem cuttings to low, sprawling plants with an average top diameter of 8 to 12 inches. Although each of these species was rated as good to very good for ability to root at the nodes, none exhibited this desirable quality in the field tests. Heavy losses among these three species occurred with the first sharp drop in temperature.

Mesembryanthemum croceum gave the most promise on two plots, located at about the elevations of 2,500 and 2,700 feet. This species withstood a near-surface temperature of 11 degrees F. with only about a 24 percent average loss on the two plots. Survival on the southeast exposed plot dropped to about 2 percent during the following summer, while survival on the westerly exposed plot dropped from 50 to 22 percent. During the next year all remaining *Mesembryanthemum croceum* disappeared, presumably crowded out by native vegetation.

The less vigorous species, *Mesembryanthemum lehmannii, M. chilense, Stomatium agninum,* and *Euphorbia mauritanica* were lost in large part during the first long, dry summer period, and were almost completely

(*Continued on page* 196)

Kentucky 31 Fescue Proves its Value

W. J. FONVILLE

Many acres have "gone to grass" within the past decade and there are many more which should go as the best safe use for them. In the logical search for adapted grazing plants which has gone along with this change several plants have demonstrated real merit. Of the grasses tried, two varieties of tall fescue have been rather outstanding, especially in the Southeast. They are Kentucky 31 and Alta.

THE WIDE ACCEPTANCE of Kentucky 31 fescue by farmers in the Southeast would indicate superiority over Alta. However, there is very little difference between them. It may turn out to be a matter of individual choice rather than any real advantage one may have over the other. Opinions differ also as to whether Kentucky 31 has any great advantage over orchard grass, or other well known grass.

The purpose of this brief report is mainly to re-emphasize some of the virtues of Kentucky 31 fescue, and also to admit in the beginning that it is no miracle plant. As with other grasses, better grazing is obtained when it is grown in combination with a legume. Ladino clover is at present the most preferred legume for this sort of combination.

Widely Adapted

Kentucky 31 was discovered by W. M. Suiter on his mountain farm in Manifee County, Kentucky about 1890. In 1931 the Kentucky Agricultural Experiment Station made trial plantings of seed donated by Mr. Suiter. Ten years later the Soil Conservation Service bought 70 pounds of seed from B. F. Suiter, a son of the original discoverer, for nursery planting. From this start seed were grown in Soil Conservation Service nurseries and distributed for observational plantings through Soil Conservation Districts in 687 counties of the Southeastern States.

Farmers in soil conservation districts harvested from those observational plantings more seed for adding to their own acreage and for sale to others. In 1951 the total seed harvest in the Southeast amounted to seventeen million pounds, enough to plant at least one million new acres. This year indications are that there will be enough for double that amount of new planting.

Many of us are already familiar with this method of distribution and the trial plantings made. The purpose in restating it here is to emphasize its distribution over rather widely varying conditions of climate, soil and farming systems. From reports by farmers from all over this territory the grass did well. This held true, according to R. Y. Bailey, Regional Research Representative of the Soil Conservation Service, on land ranging from places too wet for other pasture grasses too steep, rough and eroded hillsides. Best growth was on soils of me-

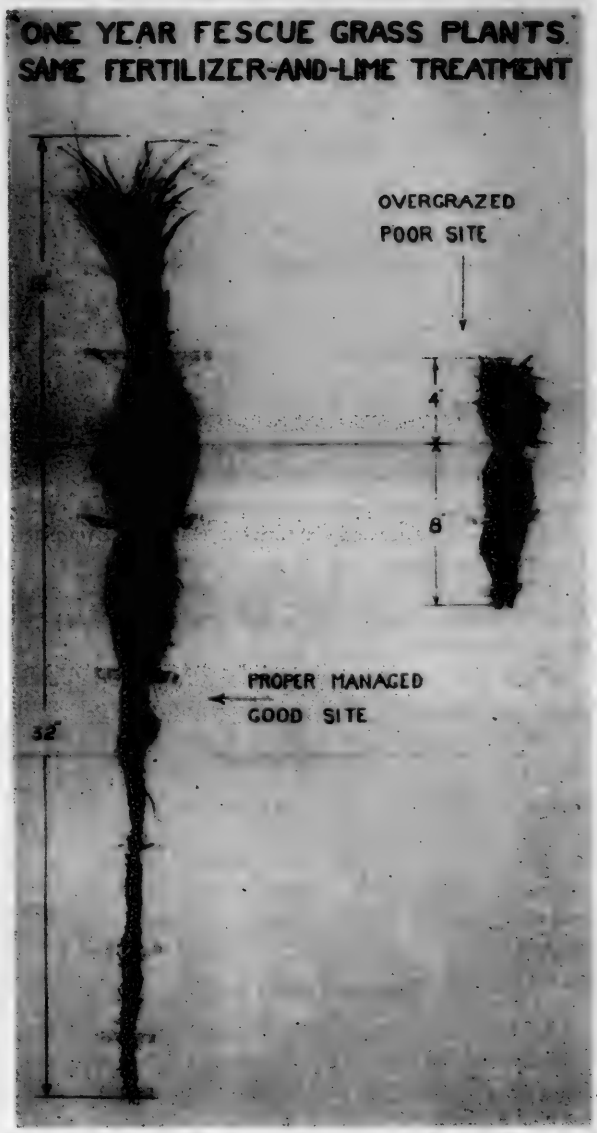


Figure 1. Fescue, like any other grazing plant, will respond to good land and good management. One advantage is especially well illustrated here in that feeding zone is shown to be four times as deep where the site and management were both favorable.

W. J. Fonville is President of the North Carolina Association of Soil Conservation District Supervisors.

Figure 2. Fescue sod, when well established, resists cutting action of flowing water and will thrive in moderately wet places. This makes it a good plant to use in meadow waterways.

dium to heavy texture. It is not well adapted on soils of light texture.

While tall fescue is primarily regarded as a grazing plant, it lends itself well to a dual purpose use where pastures are clipped for hay. It is usually advisable to plant more acres in pasture sod than would be needed in normal seasons for grazing the numbers of livestock present. Then in dry seasons the sod is not so apt to be overgrazed. The surplus in favorable seasons can be clipped for hay. Some farmers prefer tall fescue over orchard grass for hay and say it has more body after curing.

Research Data Scarce

Unfortunately, there have not so far been enough research results available. There was, however, published in the August 1952 issue of County Agent and Vo-Ag Teacher, an article giving some recent experimental reports. This was by R. E. Hodgson, Assistant Chief, Bureau of Dairy Industry.

Of especial interest in the findings referred to is the comparative protein content, 16.0 per cent for orchard grass with Ladino clover and 19.5 per cent for tall fescue with Ladino clover. When planted without clover and without nitrogen fertilization the results in this instance showed 0.8 per cent higher protein in orchard grass. The protein yield per acre was almost exactly the same for the two grasses without clover but 1,174 pounds for orchard grass and 1,374 pounds for tall fescue when the grasses and clover were grown together.

Those data were obtained, according to footnote to Mr. Hodgson's article, from the Division of Forage Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture.

Report of another test from the same source showed the influence of Ladino clover on protein and total dry matter yield. Orchard grass alone produced 2,392 pounds of dry matter per acre compared with 2,944 pounds produced by tall fesue alone. The per-acre yield of protein in this case was 231 pounds for orchard grass against 303 pounds for tall fescue. Orchard grass and Ladino clover when grown together produced 7,981 pounds of dry matter compared with yield of 7,671 pounds by tall fescue and Ladino clover grown together.

Those results indicate a very favorable feeding value of tall fescue compared with orchard grass.

Farmer Experience

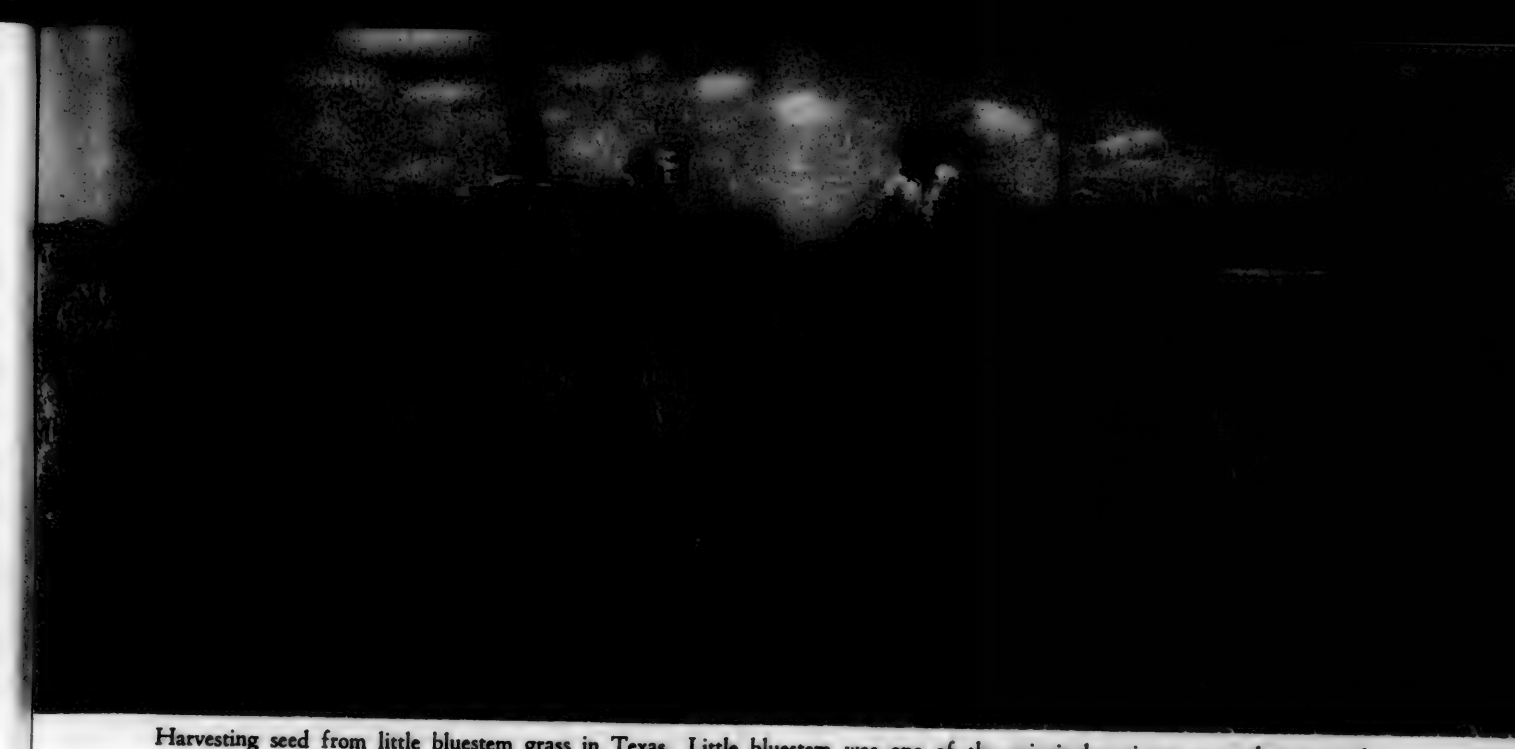
Reports were obtained by the Soil Conservation Service from 208 farmers in the Southeast who pastured a variety of livestock on Kentucky 31 fescue. Most of the farmers had a fescue and Ladino clover mixture. These reports were generally very favorable.

Only one farmer's report was unfavorable as to palatability. This was where cattle were turned on fescue after the seed were ripe. The grass had not been previously grazed that year. The cattle refused to eat the old tough growth, as undoubtedly would have been the case with almost any other perennial grass under similar circumstances.

Some farmers said their livestock liked fescue in preference to other pasture grasses. One in Virginia said his cattle preferred Smooth bromegrass to fescue but liked fescue better than several other pasture grasses used in that section.

There are people who have not become well acqainted with fescue who are apt to say: "Sure, beef cattle will eat anything. My dairy cows are more particular about what they graze."

Among the reports referred to was one from Joe Strickland of Pheba, Miss., who grazed dairy cattle on fescue and white clover, which reads as follows: "I half-heartedly planted 10 acres of my worst land to fescue and white clover. It is now the best pasture on my place. I put nine cows on this grass and clover on December 10. On March 20 I took them off so I could save seed, but in three days milk production had dropped five gallons

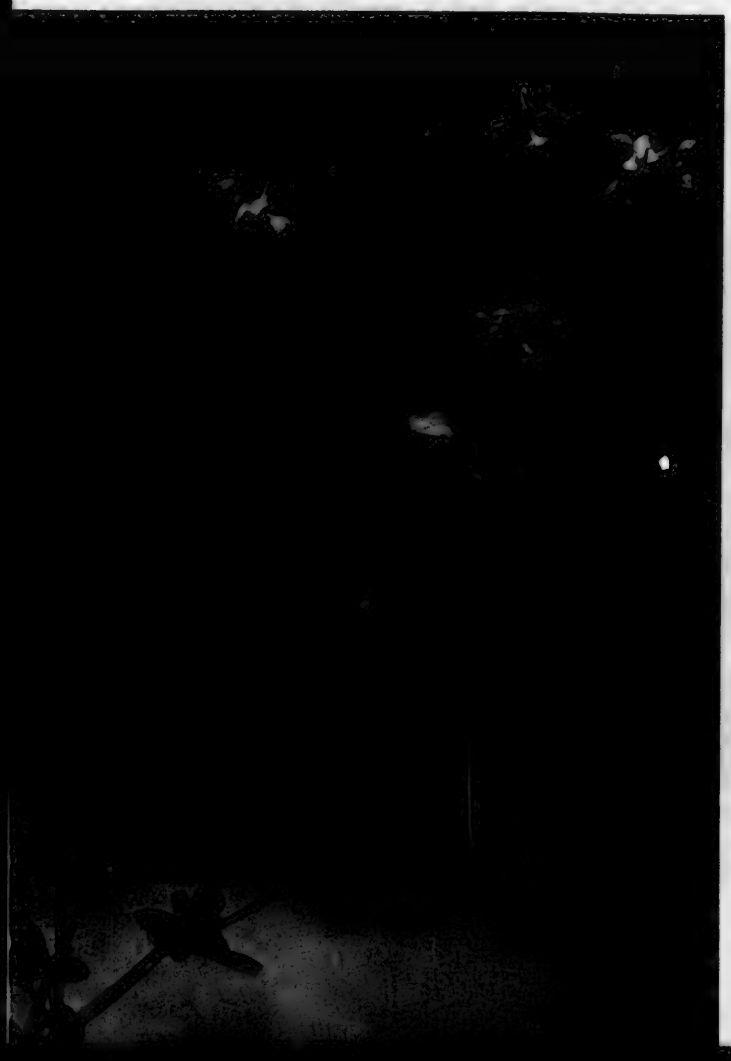


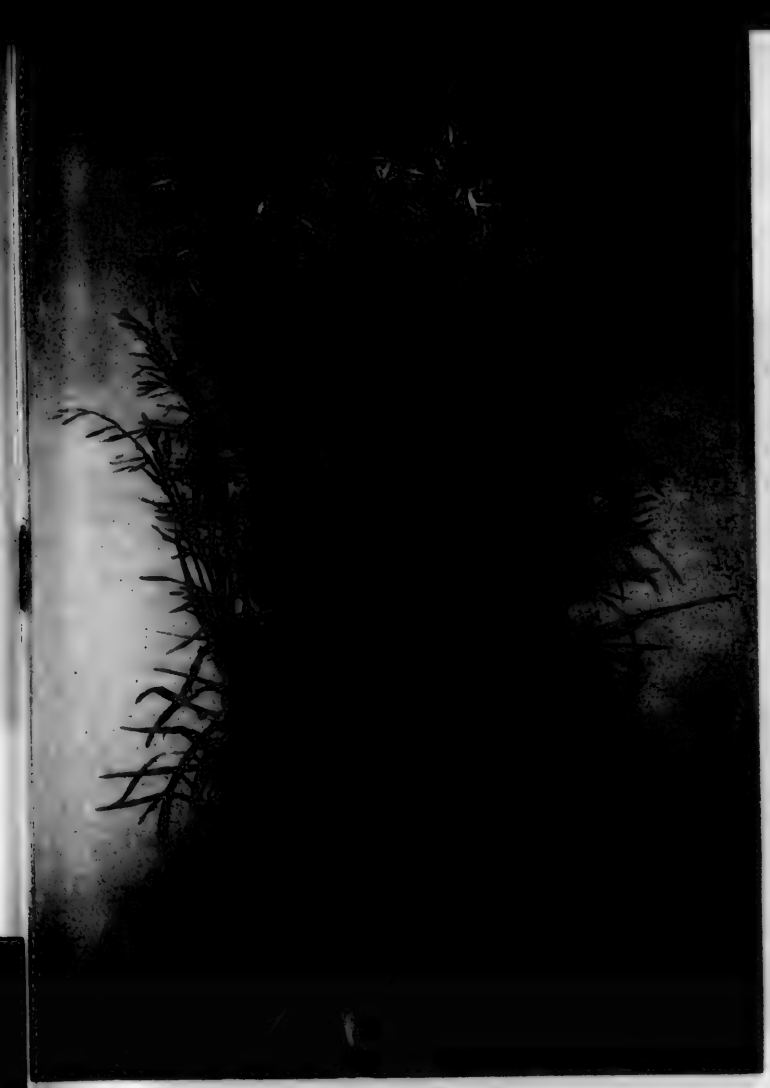
Harvesting seed from little bluestem grass in Texas. Little bluestem was one of the principal native grasses that covered the prairies of the United States. It was the principal ingredient of most prairie hay harvested since the country was settled. It was gradually being eliminated, however, until the soil conservation and grassland movements of recent years. Now, seed from this valuable plant is being harvested in large quantities and artificial reseeding of eroded lands and ranges has been accelerating each year. It is being used extensively in the flood prevention program in the Washita river watershed in Oklahoma.

Hereford steers grazing a pasture of smooth brome in Iowa. Smooth brome grass is a native of Europe and Asia. It was first introduced to the United States in 1884. It has been grown widely throughout the midwest for several decades. The acreage of this valuable grass has tripled or quadrupled, however, since the grassland boom got underway.

Bottom Left. Cascade Lotus is a new strain of birdsfoot trefoil developed by the Soil Conservation Service Nursery at Bellingham, Washington, after 15 years' work to produce the desired characteristics. This legume does well on soil too shallow for alfalfa or too poor or dry for ladino clover. It has unusual vigor in the seedling stage and will make a good stand where the comomn varieties will fail. Over a five year period it produced as much forage as the best varieties of alfalfa under test at Bellingham. At the present time Cascade Lotus is only recommended for use in the milder climates west of the Cascades along the Pacific Coast.

Bottom Right. Akaroa is an outstanding strain of orchard grass from New Zealand which has been "naturalized" for use on the Pacific Coast. Up until the present time this grass could not be released to farmers as there was no way of getting it to produce seed in sufficient quantities. This problem was solved when the Soil Conservation Service tried growing it at the Pleasanton Nursery in California. There it was found to produce seed in abundance, averaging 500 pounds per year. Akaroa orchard grass has many advantages over the common type in the amount of leafy growth it produces, its uniformity, late maturity and lack of heavy, coarse stems. It matures about two weeks later than common orchard grass, which is an advantage when grown with legumes in a pasture mixture, as it is ready for hay cutting about the same time they are.

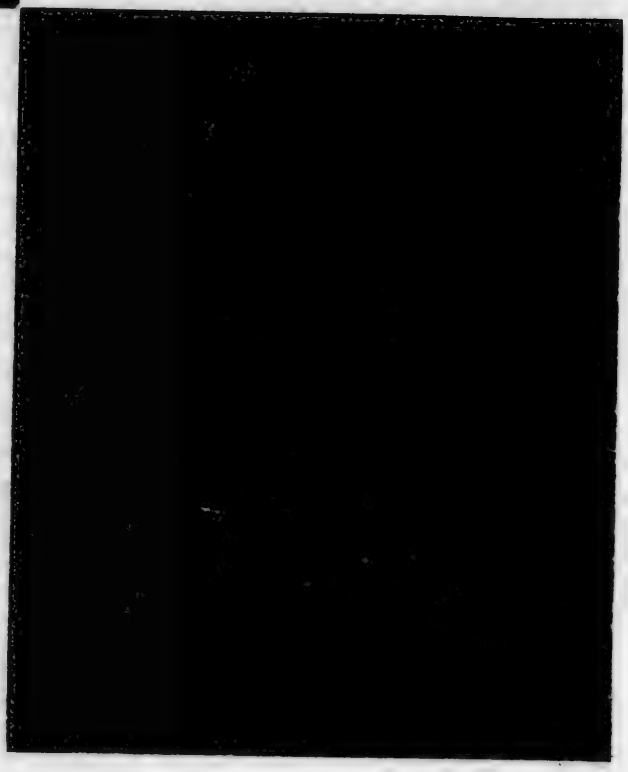




Top Left. Manchar is the name given to this outstanding northern type smooth brome. This grass was developed in the Pacific Northwest from almost 100 accessions that were gathered from all parts of the world. It fits the agriculture and the climate of the Northwest better than any other variety. It is leafy, a good forage and seed producer, carries its leaves high on the stem and spreads slowly. The most valuable feature is the good summer growth when most pasture grasses and other bromes are making only moderate growth. It is clean, there are no troublesome diseases.

Top Right. Topar is a new wheatgrass chosen after careful testing of eight accessions of pubescent wheatgrass. It was introduced to this country from Tashkent, Turkestan, U.S.S.R. This new wheatgrass has just been released to farmers of the Pacific Northwest by the Aberdeen Soil Conservation Service Nursery and the Idaho Agriculture Experiment Station who developed it. Topar is chiefly a range plant and grows much like intermediate wheatgrass, but is more drouth resistant and will do better on low fertility soils. Its outstanding feature is its palatability and use for late summer grazing. Stock like it better than any of the other wheatgrasses. It can be seeded either in mixtures with legumes or alone and does well at the ten inch rainfall level. It will outyield smooth bromegrass in tons of forage under dryland conditions and will grow just as well in alfalfa mixtures. It can be grazed three to four weeks longer in the spring than crested wheatgrass or beardless wheatgrass, while stock can be started on it just as early. Topar wheatgrass is an excellent seed producer yielding 400 pounds per acre under irrigation.

Left. Pensacola Bahia grass. This grass was first discovered by a nurseryman at Pensacola, Florida. It doubtless came to that port as a stowaway on some ship from South America, because that is the original home of the Bahia grasses. This strain was tested and multiplied at several Soil Conservation Service nurseries of the southeast. It proved to be a valuable pasture plant and is now spreading rapidly over that region.



Right. Coastal Bermuda. This is a more robust form of Bermuda. It is not as winter hardy but produces much more forage in the southern States than does common Bermuda. It is now being used extensively and with phenomenal results on many pastures of the Gulf coast States and Georgia. Bermuda grass is a native of Asia. It has spread over most of the tropical area of the world, however, during the last few centuries. Until recent years it was considered a very obnoxious weed by most farmers in the southern states in this country. Since the soil conservation and grassland movements got underway Bermuda has come to be recognized as one of the most valuable plants of the region. It is now used extensively in waterways and on eroding hillsides. It is also a valuable pasture and lawn grass.

a day so I put them back. I took the cows off again in April and the same thing happened, so I decided it would be cheaper to let cows eat the grass and then sell the milk and buy fescue seed. . . ."

Others have reported 15 to 40 percent gains in milk production when they moved their cows from other pasture to fescue.

Bailey Brothers of Woodleaf, N. C. received from their Soil Conservation District some of the fescue seed for observational planting in 1947. From this they harvested seed each season since, finding ready sale for the surplus over what was used for planting additional acreage.

In 1951 they harvested a total of 18,000 pounds of seed, and in 1952, 40,000 pounds. This year's harvest was from 165 acres of a pure stand, i.e., without Ladino clover. Their idea was to use the fescue primarily for seed production until seed prices should reach a low sale price, then add Ladino clover for grazing.

Since then they have found they can get a large amount of winter grazing after harvesting seed and this is done now for a per-month grazing fee. Farmers from mountain counties, about 125 miles distant, truck cattle to the Bailey farm for wintering. Last season they grazed 170 head from November 1 to April 15 without anything fed to the animals other than salt. No figures are available as to weight gained, but all cattle left the pasture in April in good condition. These farmers have already contracted to carry a capacity number through next winter at an advance over the price received last year.

Bailey Brothers maintain a thrifty sod by fertilization. Since there is no summer grazing done, there is an accumulated growth made during the late summer and early fall. With no legume present to help supply nitrogen a more liberal amount is applied each year.

Adam Lockhart of Wadesboro, North Carolina, says: "I have been grazing cattle for fifty years. Fescue can't be depended on in the hot, dry summer months here. It is still the best pasture grass I have yet seen."

Management is Key

By way of summary, it would seem that the value to be expected from Kentucky 31 fescue depends on how it is managed. This would, of course, include proper fertilization. That is my own opinion based on observation and from what information I have been able to get from authoritative sources.

Fescue pasture, with or without a winter legume, should be protected from grazing for sufficient time in late summer and fall to accumulate considerable growth if much winter grazing is to be expected. Fescue is more tolerant to cold than some other grasses. The blade tips will be browned over by freezing weather, but if there is sufficient volume of growth livestock can find succulent, green material underneath. It is a valuable winter grazing plant, not because growth continues in freezing or near freezing weather, but because an earlier growth is stored and remains palatable.

Regular and sufficient applications of fertilizer should be made to insure a good volume of growth and for the value and palatability of the forage produced. Better results can always be expected if white or Ladino clover is planted along with the fescue. Overgrazing or underfertilizing fescue, as with other pasture grasses, is much like killing the goose that laid golden eggs. Clipping surplus growth in late spring while there is still plenty of moisture will usually help insure palatability.

Since both fescue and Ladino clover are cool-weather plants this combination lacks something in the Southeast of being perfect. But it has many good points.

Fescue is a good feeder. Its root system is especially dense and strong under suitable growing conditions. After a sod has become well established it is sufficiently strong to bear the weight of grazing animals, even on moderately wet land. In this way your animals are walking on the sod rather than on the ground and miring up.

The virtues of Kentucky 31 fescue appear to far outweigh its faults. Properly managed, it is an exceptionally good grass.

Figure 3. Fescue looks tough and coarse. Properly managed, however, it is relished by livestock and has a feeding value comparable to other well known pasture grasses.

The Farm Fish-Pond; A Cornerstone of Ancient Agriculture

E. D. KNIGHT

The earliest records of Vivaria (fish-ponds) are to be found among the pictorial relics of the ancient Egyptian civilization. The Greeks apparently overlooked a bet in this connection, but some two thousand and more years ago in the Roman Empire the "economic fishpond" had been developed to a degree of magnificence, diversity and financial importance that has not been since achieved or is at all likely to be attained in the future.

MOST OF US THINK of the Romans, apart from road building and architecture, as hard bitten, swashbuckling soldiers or epicurian wasters, in most respects corrupt and impractical. As a matter of fact the Roman Empire was by far the most practical of the ancient civilizations and its advancing Legions brought some orderliness of methods and sound economic practices into every nation they conquered. Among other things the Romans achieved an agriculture that incorporated, with few if any exceptions, every basic feature of what is considered good farm management today.

The deficiency of our knowledge is largely due to the traditional practice of limiting the teaching of Latin, to those not going in for graduate work on the subject, to a few selected authors who deal largely with Rome's conquests and politics. How wonderful it would be if our educators, at least in the case of those students preparing to take Agricultural degrees, would throw Caesar, Cicero, Livy, and Virgil out the window and substitute instead Columella, Pliny, and Varro. Agricultural students instead of being burdened with ancient history, most of which is promptly forgotten, would learn something of practical value and economic importance to their future profession, and best of all they would achieve a humility in the realization that their future profession was one of the most ancient of the arts brought to a high degree of perfection before the coming of Christ, and that they were not learning new practices but rather the application of new machinery, new materials and other improvements of modern science to sound basic methods whose actual discovery is shrouded in the mystery of time.

Fresh Water and Salt Water Fish Ponds

The Romans had two general sorts of fish ponds and two general theories. Their fresh water ponds usually were constructed to utilize poor land which would produce a crop of fish to a greater economic advantage than a crop of grain. When the fertility of the land improved to the point where a greater dollar yield could be obtained from grain the pond frequently was drained and seeded to harvest.

The salt water pond was a more elaborate affair involving considerable capital investment and considerable risk. Most of these were constructed by "gentlemen fish farmers" of considerable wealth and apparently were an insidious hobby susceptible to constant elaboration. The owners went in not only for a wide variety of fish but for lamphrey eels (considered quite a table delicacy in those days) and various shellfish. Varro tells us of his friend Hirrus who lent Caesar, for the occasion of a triumphal banquet, two thousand lamphrey eels, which by the way he would not sell or give but insisted that he be repaid in kind. After Hirrus' death his Villa sold for four million sesterces (around $150,000.00) "owing to the great quantity of fish in its waters." The fish in the ponds of Lucullus likewise sold after his death for three million sesterces.

Pliny describes the elaborate layout of Fulvious Hirpinus who had not less than four ponds for winkles; one for the famous Rieti species, renowned for their whiteness; another for the Illyrian variety, famous for their large size; yet another for the highly prolific African breed; and a fourth for the Solitanes which were the most choicely flavored.

Yet there were some practical and successful salt water fish farmers. Sergius Orata was probably the outstanding example. He took his second name out of compliment to the fish which had made him his fortune and became in fact a millionaire fishmonger.

Ancient and Present Day Patterns Similar

Thus we see that fish farming in ancient Rome followed much the same pattern as present day agriculture in America. The fresh water pond was simple and inexpensive to construct and paid its own way in practically all cases. The salt water pond, which was in actuality a tidal basin connecting directly with the sea, was expensive to construct and usually the adjunct of an elaborate Villa and estate. In most cases it was an expensive hobby but it could be made to pay very sub-

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stantial returns by those who operated on a strict commercial basis.

It is probable that the Romans introduced the fish pond into Great Britain. It has been stated that a fish pond was constructed as a necessary adjunct to each Monastery so that the inhabitants might have at hand a ready source for food during Lent. Be that as it may, the fish pond early became an important and integral part of British agriculture. Most of the early British writers on farming dealt with fish ponds, some of them copiously.

It might be of interest here to make a comparison between farm ponds at the turn of the eighteenth century and farm ponds today. Our present program of farm pond construction and operation features three points:

1. *Construction of the pond as inexpensively as possible by erection of an earth dam with a clay core.*
2. *Fertilization of the pond with chemical fertilizer to promote growth of plankton.*
3. *Stocking of the pond with fish of such varieties and in such numbers as to achieve the most desirable balance and produce the greatest annual yield per acre in edible fish.*

In "*A Discourse of Fish, and Fish-Ponds,*" written by "*A Person of Honour in the County of Norfolk,*" and "*Printed by E. Curll over-against Catherine-Street, in the Strand,*" in 1726, directions are given for the construction of a dam. These are in part as follows:

"*Now first, for making the Bank or Head, you must be sure it is tight and that it do not sew or leak, as it will certainly do, if it be composed of mere Earth; therefore a Bed or Wall of Clay the whole length of the Bank, must be carry'd up with good Ramming, from a Foot or two below the Surface of the ground, to such Height as you propose the water shall stand.*"

"*If you do not give the Bed of Clay this Foundation, the water lying under a great Weight from the Depth of it, will work itself underneath; so allow a spit or two at least for it. Then as you ram the Clay, you must be sure that Earth be brought to carry the Bank up with it, else the Sun will search and crack it, which is of pernicious consequence; so when it is come to its full Height, close and cover it with Earth immediately, least that Inconvenience happens.*"

"*You must allow three foot to the Breadth of this Bed of Clay, and raise it to the Height you intend the water shall stand, and lay Earth three foot higher, two foot would have serv'd, but that the allowance of one at least must be made for the sinking of the Bank; for it will do so, notwithstanding the pressing of Tumbrels, Horses, and Men working upon it.*"

Under point one it would appear that the substitution of bulldozer for "Tumbrels, Horses, and Men" constitutes the principal change in basic dam construction that has been brought about during the last several centuries.

Fertilization With Organic Fertilizers

The fertilization of fish ponds has been practiced at least since the times about which Columella, Pliny, and Varro write. In those days it was recommended that stable sweepings be dumped into the fresh water ponds and there were other definitely prescribed rules about the use of organic fertilizer.

The British seem to have re-discovered the advantages of fertilization much as we have done. Our "*Person of Honour in the County of Norfolk*" explains this as follows:

"*There is a sort of food for fish which I may call accidental, and is no less improving, than the best you can contrive; and that is, when the waters happen to receive the Wash of Commons where many Sheep are fed, the water is inrich'd by the Earth, and shall feed many more Carps, than otherwise it would. This is the case at Antlingham in Norfolk, where there are Ponds in a Common that raise Carps wonderfully, altho' the Soil be sandy and poor, and the waters seldom let out; and this earthy wash is the Reason of it. When Cattel are fed upon the Pastures by your great waters, if they have Access to them, in hot weather they will take Delight to stand in the water; the Dung that falls from them, is also a very great Nourishment to Fish.*"

Accordingly it would appear that the principal advance which we have made in some two thousand years in the matter of fertilizing fish ponds is to substitute a more exact formula of chemical fertilizer for haphazardly applied organic fertilizer of various sorts and to learn the "why" of applying this fertilizer.

Restocking Fish Ponds

In stocking ponds with fish and the use of predator species to keep more prolific pan fish in control our "Person of Honour" makes the following comment:

"*Breams put into a Pike-Pond, will breed exceedingly and are good enough to maintain Pikes, who will take care that they shall not increase overmuch.*"

Our friend from Norfolk, however, is leery of bream. In speaking of ponds supplied by watershed drainage alone he says: "*Have a great Care of putting Bream in these sort of waters; for they will grow up very slowly,*

Depaſtos capiunt piſces, vel retibus amplis, Vel dum ceruleis fraudant Vivaria lymphis.

This shows fish being harvested from the elaborate pond system of a Roman estate. It is a restrike published in either the late 18th or early 19th Century, which is one of a series of hunting and fishing prints entitled VENATIONIS, PISCATIONIS, ET ACVPII TYPI originally published in 1582 drawn by PAULO de KEMPENARE and engraved by PHILLIPPUS GALLEUS.

tho' at last they will be great; but in the mean time they breed so infinitely, and such a slimy nasty Fry, as both robs and fouls the water, making it unfit for the other Fish."

Those of us who have had difficulty controlling Bluegill populations probably do not feel so strongly on the subject but nevertheless we may take a grain of comfort from the similar problems of our forefathers.

Actually the knowledge of the principle of overcrowding and consequent stunting due to lack of adequate feed goes back to the beginning of fish ponds. It was very soon realized both that overpopulation retarded growth to edible size and that fish introduced into a newly constructed pond made a more rapid growth than in waters in use several years even though the latter were not overpopulated. If I may digress a moment here, it is to state that I have been led to understand that technicians have discovered fairly recently that fishing and fish growth reach a peak within the first year or two and then taper off in the newly impounded waters of our theoretical flood control systems. If my information is correct I can only advise that if these same technicians had cared to study the experiences of seventeenth and eighteenth century British fish pond operators they would have been forewarned to expect this result. Actually there are plenty of previous experiences of this sort in our own country to form a pattern if they were collected and put together.

Our troubles in controlling overpopulation stem from the fact that we do not yet take fish seriously as a crop to be harvested to our economic gain and hence are trying to do the job the easy way. The early Roman and later British custom of using the land occupied by a fish pond both to raise crops of fish and crops of grain was primarily a matter of economic land use; however, even when land was best adapted to continuous use as fish ponds, when it early became apparent that overpopulation was difficult to control and that fish made more rapid gains in newly impounded waters, the principle of pond rotation became an established practice and was carried out even though the pond lay fallow during its dry period. This was rarely the case, however, as usually the dry pond was planted with a crop or crops considered beneficial to the next crop of fish even though said planting was not harvested for other purposes.

Utilization of Carp and Other Fish

Another influence on both Roman and British fish pond practices was the esteem in which the Carp was held both as a table and sporting fish. While Bream, Perch, Pike, and Tench have been used to stock British fish ponds, the Carp has been the overwhelmingly popular fish. It soon became obvious that Carp populations could only be controlled and utilized at the most desirable growth point by periodic draining.

I have recently read two articles in American sporting magazines by writers who have discovered the Carp as a desirable sports fish. Our British cousins for centuries have classified their fishing as game fishing and "coarse fishing." Many anglers during the off season for trout and salmon derive great pleasure from coarse fishing and go to as much trouble to equip themselves with proper tackle and bait as our most avid dry fly enthusiasts. Among British coarse fishermen the Carp, which bears a great reputation for both its fighting qualities and its guile, has long been considered a prize well worth the taking. In the numerous books on British coarse fishing, the Carp occupies a place of primary importance.

The now somewhat controversial practice of stocking

(*Continued on page* 196)

Two-Way Plow for Maintaining Terraced Land

MAURICE B. COX

MANY INDIVIDUALS and publications have been stressing the importance of maintaining terraces. But farmers of terraced fields are becoming more concerned about maintaining the interval of land between the ridges than they are in just building a high ridge. The soil is moved from the center of the land between the ridges by plowing operations and erosion. The absence of top soil can be noticed by the accumulation of runoff water in the dead furrows instead of terrace channels, and by poor-growing crops along this line. The plants are smaller because they are growing in unproductive subsoil. When the center of the interval becomes severely low, it may be necessary to re-terrace the field, locating new terraces midway between the old ones. They will be made of subsoil, but continued backfurrowing to the ridge will tend to cover them with surface soil. This procedure, however, requires a complete and more expensive reterracing job about once each decade on some soils. Keeping a uniform layer of topsoil on the land between the terraces may seem a simple problem. When using a conventional plow, however, it can be accomplished only by varied and complicated methods.

There has been little formal research reported on the maintaining of the terrace intervals and channels. Comparisons were made of the movement of soil, by different methods of plowing, on terraced land at the Red Plains Conservation Experiment Station, Guthrie, Oklahoma, and at the Wheatland Conservation Experiment Station, Cherokee, Oklahoma. These surveys serve only as indications of changes brought about by only two methods of plowing. Differences in soil type, land slope, and cropping systems also prevent direct comparisons.

Methods of Plowing Terraced Land

Conventional Moldboard Plow.—The method of plowing on the Red Plains Station was backfurrowing to the terrace ridge with a conventional moldboard plow and leaving dead furrows in the intervals between terraces. The location of the dead furrows was varied by alternating the widths of plow lands. Several attempts were made to backfurrow the dead furrow but it was not too satisfactory with conventional plows. This was done in an effort to prevent the effects of the dead furrows. The cross section lines recorded in Figure 2 were made just after the terraces were built and again after nine years of this system of plowing.

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Where conventional moldboard plows were used, soil was moved away from the interval and onto the terrace ridge. Alternating the width of plow lands and shifting the dead furrows in the intervals may delay the mechanical erosion process. When dead furrows are left in the intervals, surface soil is moved the width of the furrow slices each way toward the terraces.

Two-Way Plow.—Terraced land on the Wheatland Station was plowed with a two-way plow (Figure 1). With it, all furrow slices were thrown in the same direction. The soil was thrown uphill two years and downhill one year. The uphill operation was started at the top of the slope or the top of a terrace ridge and plowing continued until the next terrace channel was reached. Wider sections of the intervals were plowed in the same manner, starting and ending the furrows in the channel. Terrace ridges were backfurrowed with dead furrows left in the channels. The downhill tillage was started from the bottom of the slope or the lower edge of a terrace ridge. Plowing continued until the furrows reached the lower edge of the next terrace ridge. Then the remainder of the wide sections of the intervals were worked out with all furrows starting and ending along this line. The next furrow was on the terrace and cut through the end of all these furrows. In this way all tillage was conducted with the terraces and channels.

The cross section lines recorded in Figure 3 were made just before the terraces were built and again after nine years of this method of plowing. Lowering of the terrace interval did not develop where the two-way plow was used. With the method of plowing described no dead furrows or backfurrows were left in the intervals. Terraces and channels were maintained and there was

Figure 1. Two-way plow consisting of one right and and one left hand plow bottom and controlled by hydraulic lifts. Two and three bottom (Right and Left) pull plows are also available.

no apparent change or lowering of the surface soil in interval areas. Two-way plows, therefore, seem to have a useful place in terraced fields, especially in maintaining intervals between terraces and channels.

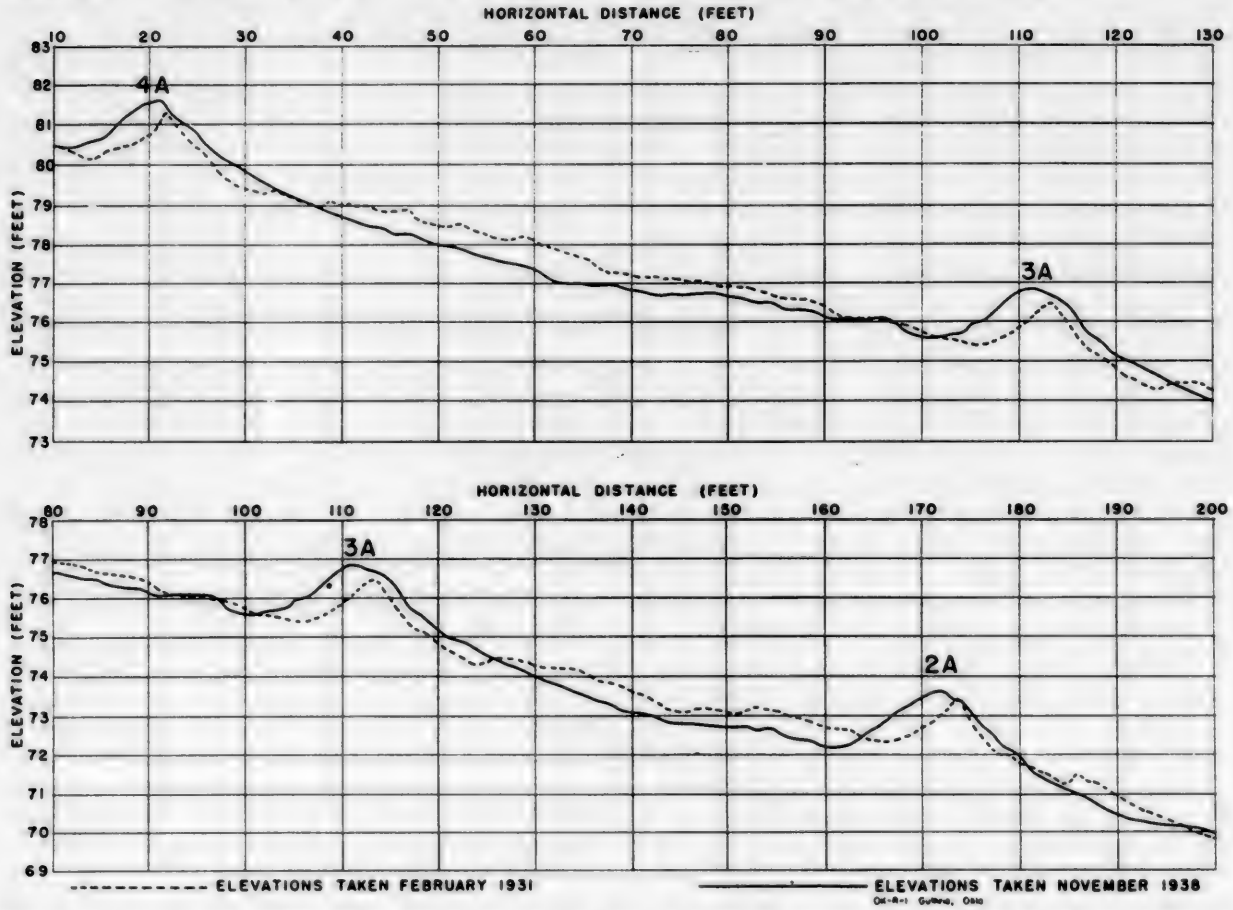

Figure 2. Conventional moldboard plowing moves soil from terraces showing the movement of soil from the interval onto the ridge during nine years of plowing with a conventional plow on the Red Plains Conservation Experiment Station, Guthrie, Oklahoma.

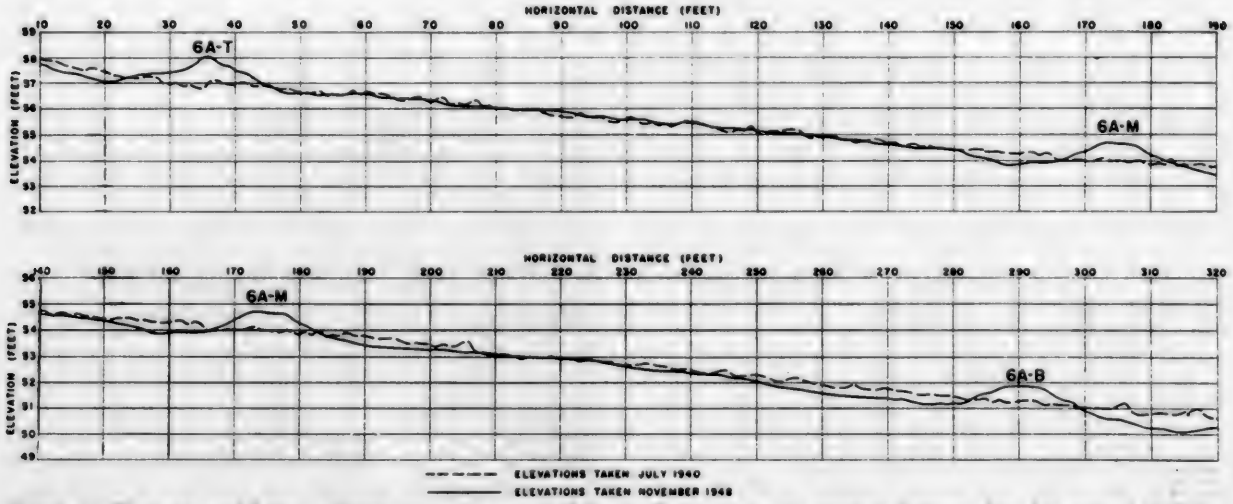

Figure 3. Two-way moldboard plowing maintains terraced land. Cross section of terraces showing that the interval has been maintained during nine years of plowing with a conventional plow on the Wheatland Conservation Experiment Station, Cherokee, Oklahoma.

Graphical Solution of Probable Soil Loss Formula for the Northeastern Region

CHARLES H. LLOYD AND GAIL W. ELEY

HUNDREDS OF THOUSANDS of quantitative measurements at soil and water conservation experiment stations since 1929 have provided basic information on the rates and amounts of soil and water loss that occur on different soils and on different slopes with different kinds and combinations of conservation treatment.

G. W. Musgrave, Research Specialist, Soil Conservation Service, published "The Quantitative Evaluation of Factors in Water Erosion" in the July 1947 issue of the JOURNAL OF SOIL AND WATER CONSERVATION. This paper summarized the findings of a group of research workers of the Soil Conservation Service on the relationship between the major causal factors and the resulting rate of sheet erosion. The data reviewed and evaluated were from nineteen research stations, and covered periods ranging from five to 15 or more years of measurement at the respective locations. It has been estimated that some 20,000 measurements were considered. From the study and evaluation of these data it was determined that the rate of sheet erosion is related to a number of major factors, and that certain relationships exist between those factors. The research men assigned appropriate letters and exponents to the major factors.

The symbols that are used to represent them in an empirical formula are:

(a) The erodibility of different soils, which varies with their physical properties and is expressed by a soil factor "F."
(b) The rainfall, which has a relationship between the amount of rain occurring within any 30-minute period and the amount of soil that is eroded during an entire storm, and is expressed by $P^{1.75}$
(c) Degree of slope in per cent, expressed by $S^{1.35}$
(d) Length of slope in feet, expressed by $L^{0.35}$
(e) Cropping factor, which may be a product of several factors and is expressed by the symbol "C."

Probable soil loss in tons per acre per year represented by "E" is equal to $F \times S^{1.35} \times L^{0.36} \times P^{1.75} \times C$. The solution of this formula for the varying soil conditions, rainfall, slope characteristics, and the associated cropping systems encountered in the field is the logical basis for the technical recommendations necessary to control erosion.

A quick, practical method of solving the probable soil loss formula on the spot for a specific set of conditions is needed so that "everyday" application of the knowledge accumulated through research can be made. Such a method has been provided for the Northeastern Region of the Soil Conservation Service by the development of a graphical solution for four rainfall curves. Data necessary for using the graphical solution have been compiled in four 2-leaf documents that cover twelve states. They are designed to fit in technical guides and field notebooks.

Some of the practical applications of research data to field problems by use of the graphical solution to the probable soil loss formula are:

(a) Preparation of technical guides and specifications.
(b) Checking effectiveness of planned practices in the field.
(c) Working with other agencies that are interested in conserving soil and water resources.
(d) Preparing conservation farm plans (planning technician uses as a tool to "sell" sound rotations, treatments, and supporting practices.)
(e) Working with groups.

The authors have made personal use of the graphical solution to probable soil loss from sheet erosion in items (a), (b), and (c) above. In each instance, it was well received and very helpful.

It is suggested that the graphical solution to probable soil-loss determination, with proper field measurements and data, could be used to:

(a) Estimate probable soil loss from large watersheds.
(b) Estimate probable rates of sheet erosion as an aid in determining sediment production rates from watersheds above impounding structures.

The following is a reproduction of one of the four documents that have been prepared for the Northeastern Region. The sample document is for an area where 1.25 inches of rainfall in a 30-minute period may be expected once in two years. The document is self-explanatory. It contains examples and data necessary for use of the graphical solution to the probable soil loss formula.

The authors recognize many of the limitations in the solution and use of the probable soil loss formula. Additional research may not be needed so much as further evaluation of accumulated research data to refine and improve the formula. In using the graphical solution to probable soil loss, it is well to keep in mind that results are relative as well as probable. Their greatest value lies in comparison of field conditions in a specific area

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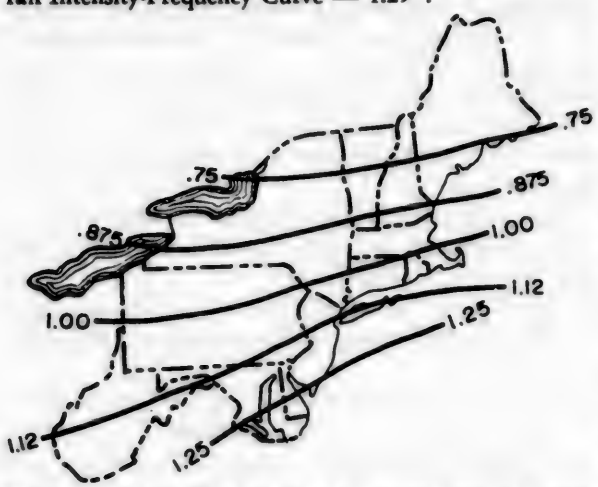
for which all factors are consistent except culture or, in other words, cropping system and conservation measures. Such comparisons have helped farmers and technicians to understand the true value of conservation measures and their relation to soils, rainfall, slope characteristics, and land use.

Graphical Solution of Probable Soil Loss Formula

For Southern New Jersey, Delaware, Maryland South of Baltimore, and Southern West Virginia, using Rainfall Intensity-Frequency Curve = 1.25".



Thirty minute rainfall in inches to be expected once in 2 years. (Curves .875 and 1.12 interpolated.) Taken from U. S. Department of Agriculture Misc. Pub. No. 204.

[1]Formula: $E = F \times S^{1.35} \times L^{0.35} \times P^{1.75} \times C$

E = Probable soil loss in tons per acre per year.

F = Soil factor (Relative erodibility of soil under continuous cultivation up and down slope)

S = Slope in %

L = Length of slope

P = Rainfall 2-yr. frequency 30 minute maximum intensity in inches

C = Cropping factor—may be product of several separate factors

= Rotation

= Rotation × contour farming

= Rotation × contour farming × strip cropping

= Rotation × contour farming × terracing

Soil Factor "F"

Ashby	.3	Conestoga	.5
Belmont	.4	Cookport	.4
Beltsville	.5	DeKalk	.1
Calvin	.3	Duffield	.3
Catoctin	.4	Elliber	.1
Cavode	.4	Ernest	.4
Chandler	.4	Evesboro	.2
Chester	.3	Fauquier	.3
Clifton	.3	Frankstown	.3
Clymer	.2	Frederick	.3
Collington	.2	Galestown	.2
Gilpin	.3	Monogahela	.5
Glenelg	.3	Moshannon	.3
Greenwich	.2	Murrill	.3
Golts	.2	Muskingum	.4
Hagerstown	.3	Myersville	.3
Highfield	.3	Pope	.5
Holston	.3	Purdy	.5
Huntington	.3	Sassafras	.3
Laidig	.3	St. Johns	.1
Leetonia	.1	Tidal Marsh	.1
Lehew	.2	Tuxedo	.5
Leonardtown	.5	Tyler	.5
Litz	.3	Westphalia	.5
Lycoming	.3	Wharton	.4
Manor	.3	Woodstown	.3
Marlton	.3	Zoar	.5
Matawan	.5	Rough Stony	.1
Monmouth	.5	Poorly Drained Coastal Plain	.2

[1]G. W. Musgrave. The Quantitative Evaluation of Factors in Water Erosion. Journal of Soil and Water Conservation, Vol. 2, No. 3, July 1947.

Value of Rotations

Compared to Continuous Row Crop Rated as 1.0

Key: R = Row crop, Rc = Row + cover crop, O = Oats, W = Wheat, H = Hay, S. cl. = Sweet Clover.

R	1.0
R, R, O, S cl.	.63
R, O, S. cl.	.50
Rc, Rc, R, W, H	.449
R, R, O, H	.389
R, R, O, H, W, S. cl.	.381
Rc, R, O, H	.367
R, O, H, R, O, S. cl.	.333
R, O, H, W, S. cl.	.264
R, O, H, H, R, O, S. cl.	.255
R, R, O, H, H	.246
R, O, H	.223
R, R, O, W, H, H	.219
R, R, W, H, H	.218
R, O, H, H, W, S. cl.	.210
Rc, R, W, H, H	.204
R, R, O, H, H, H	.197
R, R, W, W, H, H	.195
R, O, W, H	.192
R, W, H	.186
R, W, W, H	.177
R, O, O, H, H	.140
R, O, H, H	.133
R, O, W, H, H	.122
Rc, O, H, H	.115
R, W, H, H	.110
Rc, H, H	.097
R, O, H, H, H	.093
R, W, H, H, H	.079
R, O, H, H, H, H	.078
R, W, H, H, H, H	.066
O, O, H, H	.065
R, W, H, H, H, H, H	.057
W, W, H, H, H, H, H	.057
W, O, H, H	.056
O, H, H	.030
W, H	.030
O, H, H, H	.023
O, H, H, H, H	.019
W, H, H	.017
W, H, H, H	.013
W, H, H, H, H	.012
H—continuous	.003

[1]Relative Soil Loss From Crops Under Various Cropping Conditions in Percentage of Loss for Continuous Corn

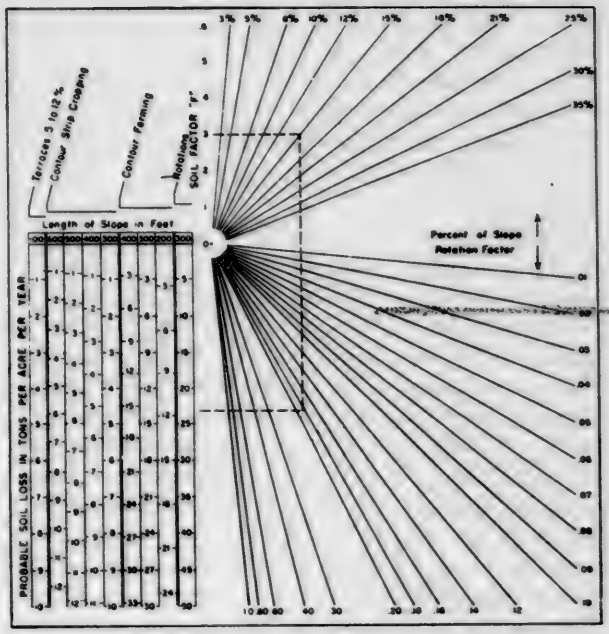
Crop	*Relative Soil Loss*
Continuous corn or row crop	1.00
Corn after sweet clover catch crop	.55
Corn after 1 year meadow	.45
Corn after 2 years meadow	.35
Corn after 3 or more years meadow	.30
Corn after corn after 1 year meadow	.85
Corn after corn after 2 or more years meadow	.65
Third year corn afer 1 year meadow	.95
Fourth year corn afer 1 year meadow	1.00
Spring grain after 1 or more years corn after sweet clover catch	.25
Spring grain after corn after 1 year meadow	.21
Spring grain after corn after 2 years meadow	.17
Spring grain after corn after 3 or more years meadow	.15
Spring grain after second year corn after 1 year meadow	.25
Spring grain after second year corn after 2 or more years meadow	.22
Spring grain after third or fourth year corn	.25
Spring grain after 1 year meadow	.10
Spring grain after 2 or more years meadow	.08
Spring grain after spring grain after 1 year meadow	.21
Spring grain after spring grain after 2 or more years meadow	.17
Spring grain after winter grain after 1 year meadow	.21
Sping grain after winter grain after 2 or more years meadow	.17
Winter grain after corn after 1 year meadow	.10
Winter grain after corn after 2 or more years meadow	.08
Winter grain after 1 year meadow	.05
Winter grain after 2 or more years meadow	.04
Winter grain after spring grain after 1 year meadow	.10
Winter grain after winter grain after 1 year meadow	.10
Winter grain after spring grain after 2 or more years meadow	.08
Winter grain after winter grain after 2 or more years meadow	.08
First year meadow	.009
Second year and succeeding meadow	.003
Lespedeza hay	.02

Cover crops in rows reduce loss of the row crop one-fifth. Use of field cultivator on meadows, instead of plowing, reduced loss of crop following meadow by 75%. Good meadows of grasses and legumes are assumed in above estimates.

The rate of soil loss for a rotation can be calculated from the above table. For example, the value of a R-W-H rotation is .186, which is obtained as follows:

Corn after 1 year meadow	.45
Wheat after corn after 1 year meadow	.10
First-year meadow	.009
	.559 ÷ 3 = .186

[1]Ready References for Conservation Farm Planning, Soil Conservation Service, Region III, Milwaukee, Wisconsin.



Method of Calculating Probable Soil Loss

Problem: Determine probable soil loss on 300′ slope of Class III (15% slope) Chester soil when:

1. A 3-year rotation of corn-wheat-hay is used.
2. Contour farming is added to 3-year rotation.
3. Contour strip cropping is added to 3-year rotation and contour farming.

Solution: Chester soil factor "F" = .3; corn-wheat-hay = .186.

Locate .3 on soil factor "F" ordinate. Follow dotted line horizontally to the right until it intersects 15% slope line. Follow dotted line downward until it intersects .186 rotation line. Then follow horizontally to table at left where soil loss in tons can be read directly for each of the above conditions. Thus:

Condition 1—Rotation = 23-ton loss.

Condition 2—Rotation × contour farming = 13-ton loss.

Condition 3—Rotation × contour farming × strip cropping = 4.7-ton loss.

Conservation—Everyone's Way of Life

JOHN H. WIKSTROM

History proves that conservation must be made a part of our way of life, influencing all that we do including our economic activity, and becoming a real part of our political and religious philosophy. The following is the author's attempt to present the facts of history that support this conclusion.

"MAXIMUM PRODUCTIVE use of each acre of land in accordance with its capabilities" is what we are actually striving for in our conservation program. Attaining this goal in perpetuity involves the problem of getting each acre allocated to the highest use or uses that it is capable of sustaining. Traditionally, allocation of land to different uses has been a function of the market. Consequently, our failure to allocate land to its proper use implies functional weaknesses in our market activity as one major factor. What are these weaknesses? What are we doing to correct them?

To arrive at the answers, we must consider (1) the factors that, historically, have influenced the market function; (2) the weaknesses in our economic allocation of land; and (3) what we are now doing and what we should be doing to correct these weaknesses.

Factors That, Historically, Have Influenced the Market Function

History tells us that all societies, even the most primitive tribes, developed philosophies of life based on their experiences and instinct, and as in the case of the West, supernatural influences. It tells us further, that these philosophies formed the basis for all phases of social control, including the economic and political. We find, for instance, that primitive peoples living directly from nature, developed simple philosophies that reflected their experience with nature. They incorporated their experiences, including those of land and resource use, into their religious and social customs. The Iroquois Indians who relied heavily on fish for food recognized their dependence on the natural supply. To safeguard that supply, they banned fishing during the spawning season. Violations of this code were considered sins against the Spirit of Great Wacunda. The Aztecs, more specialized in their production, allocated land to members of the tribe for two-year periods. If the land had been abused at the end of that time, the user's right to it was revoked. Some pagan societies such as the Chinese, who experienced crowded living conditions early in recorded history, developed relatively high natural philosophies. China's principal religious philosophers incorporated natural experience into their religions. To the Taoists particularly, any abuse of nature was a sin. As a result we find their economic activity, including the allocation of land, held in check to conform to their philosophy and the restrictions based on it.

The West has had a somewhat different history than the societies just cited. In comparison with China, it is only recently that western civilization has experienced crowded living, and then only locally. As a result we are late developing a realistic regard for nature. Nature was long considered something that had to be fought. Resource abundance and our rich industrial development causes us to almost forget that nature was the source of wealth. Furthermore, our history has been contrastingly different from that of the Chinese, or other Eastern societies, primarily because of the influence of Christianity on one hand and the disregard for it on the other.

Consider briefly the economic development of the West. Property rights developed quite naturally in the West as they did in older societies. Pre-Christian philosophers developed natural philosophies sufficient to sustain Athens and Rome for a time. Rather early in this development, the Author of Christian life was born. In the early days of Christianity we find the Church expounding man's natural obligations. We find the Medieval Church exerting a very strong influence on economic life. The latter part of this period saw production, arts, and labor specialization developed to quite a degree. The Crusades had reopened the trade routes to the East and Commerce expanded to include trade with more widely separated people. At this stage, merchants dealing away from home and their own community became less scrupulous. As mercantilism developed, traders became less desirous of keeping within the moral code. As a consequence of the Reformation the merchant class was quick to effect a divorce between religion and business. Men of business were strong enough now to force the collapse of feudalism and to bring about the establishment of the political state. Political rulers became infatuated with the prospects for wealth apparent in the industrial development that grew out of mercantilism. Business grew strong and dominated politics. Business replaced nature as the source of wealth. The result was the evolvement of the laissez-faire concept of philosophy under which America was settled and developed.

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Weaknesses in Our Economic Allocation of Land

The period that produced the laissez-faire policy was a time of obsession for wealth and it developed into a ruthless exploitation of resources. However, our experience with laissez-faire was not all wealth. We experienced an unusual amount of social and natural resource abuse. We were able to continue under the policy as long as we had free land to offer the oppressed and apparently unlimited resources to exploit. When the limit was reached, the oppressed began to challenge the wealthy for a share of what was produced. As a result of this experience, economists began to question the very nature of economic thought.

The economists of the period that produced the laissez-faire concerned themselves with the process of wealth. While these men, commonly referred to as the classical group, quite thoroughly understood the synthesis of wealth, they never concerned themselves with the functioning of the economy other than that the major function of the time was to exploit resources and produce wealth. With the change in circumstances brought about by the end of free land, economic thought turned toward wealth distribution. The big discovery of the time was that man was a social being. Not of course that this was something new, but society had strayed so far from nature that this fact had come to be ignored. It was discovered among other things that man was not motivated exclusively by the drive for material wealth. Certainly, he desired wealth, but first he wanted to meet the needs of his state in life and possibly other natural satisfactions. The fact was that ethical forces were among those most important in influencing men to act in a manner economic. Alfred Marshall observed: "But ethical forces are among those which the economist has to take account of. Attempts have been made to construct an abstract science with regard to the actions of an 'economic man,' who is under no ethical influences, and who pursues pecuniary gain warily and energetically, but mechanically and selfishly. But they have not been successful, nor even thoroughly carried out, for they have never really treated the economic man as perfectly selfish. No one could be relied on better to endure toil and sacrifice with the unselfish desire to make provision for his family; and his normal motives have always been tacitly assumed to include the family affections. But if they include these, why should they not include all other altruistic motives the action of which is so far uniform in any class at any time and place that it can be reduced to a general rule? There seems to be *no reason*."[1] (Emphasis added.)

Since the allocation of the factors of production and the appropriation of goods produced was a function of the market activity, the new academic approach was to analyze critically the market operation. However, the idea of unrestricted competition had been thoroughly entrenched, industrial technology was progressing rapidly, and business still dominated politics. From this experience we evolved the concept of free pricing or free competition—that is, the belief that the free market would quickly lead any idle land, resources, labor, enterprise, or capital back into production and would thus correct automatically any evil of non-use. Economists of this period explored the market and the various aspects of man's nature as they influenced his activity in the free market.

Continued social and natural resource abuse, aggravated by recurring depressions and culminated in the great depression of the 1930's with the severe drought and dust bowl, proved the free market concept false.[2] During this period men could have offered to work for nothing and still not found work. People were starving at a time when there were surpluses. Interest rates sank to zero. Obviously there were other laws governing economic life. The free market had also failed to accomplish wise allocation of land. The market could determine the rent for a given use and production, but it could not change the nature of the land to fit the use. And yet the competitive system was not proved worthless. The free market has always been valuable as an automatic allocator of land, resources, and labor, as a stimulator of output, and in determining rewards. But its usefulness was within limits. If we were to protect our human resource, among other things, the nature of man would have to determine the manner in which human service could be entered into the market. Also, if we were to have proper land use, the nature of the land would have to determine the manner in which the market could act upon it.

Correcting Weaknesses in Economic Land Allocation

The question is, how do we go about limiting the manner in which the market can react on land? The first answer might be to just limit market activity in allocating to be consistent with the nature of the land and the effect of different uses on it. That is, of course, what we hope to attain, but it is not a simple task by any means. Since political and religious philosophies are the most important factors influencing economic activity, we are confronted with the task of influencing the philosophy of a people. To do this we must (1) learn and be able to demonstrate what proper land use is; (2) teach and develop in the public the desire to practice proper land use; and (3) create the environment in which they can do it. In general this is what we are trying to do.

We have made great progress in our research to learn

the principles governing land use. We know a great deal about the effects of different land treatment such as plant rotation, cover crop and row crop farming, contouring, irrigating, etc., and about when and where they should be applied. We can quite accurately determine soil needs and we know how to maintain soil fertility and build soil quality. Many of the relationships of soil to water and soil to plants have been discovered. While we no doubt have a long way to go in the way of research, we do know enough now to prescribe reasonably good use for any particular land condition. We have also developed the research technique to handle most land use problems.

The gap between our technical knowledge and public practice indicates that we have not been very successful in teaching the public and creating in our people the desire to practice good land use. There are a number of reasons for this:

(1) We are a new country and while we have experienced harsh social and natural resource abuses, we have not had sufficient experience to mold a natural philosophy.

(2) We are a secular society divorced from the past, consequently we have not taken advantage of the lessons of history on which to build a philosophy. Our education has been directed toward the skilful exploitation of resources, and not toward the building of a cultured society. Even though Christianity continues to teach man's obligations to his fellowman and to nature, the same as it did in Medieval times, as a national society we ignore these truths. This is an important point because, as in the case of China, we see how even pagan peoples who had developed a relatively high natural philosophy could not attain social justice in its land policy. Consequently Communism has been able to appeal to the Chinese people under the guise of agrarian reform.

(3) Public education is a difficult and slow task. Civil authority springs from the people, and before the people can give authority to act, they must have the knowledge and experience upon which to reflect. The public will not provide itself with teachers or correct its educational program until it learns its errors from experience. This puts those cognizant of our conservation needs at an extreme disadvantage. They must work diligently to make converts to their cause by pointing up errors and demonstrating good land usage until they have the support to underwrite corrective measures. This is not easy when you consider that in areas of more extreme social neglect, such as we have in the South, bad land practices like land burning and one-crop farming have become a matter of custom.

Creating the environment in which good land practices can be carried out is a multiple task. There is the educational aspect that has been covered, but aside from that is the task of eliminating the uncertainties the land user is faced with, and correcting the political errors of the past. We have accomplished a great deal in the way of stabilizing the land user's income since the depression days through production payments, subsidies, and planned production. What more could be done or whether all that has been done is good is hard to say since we have not had sufficient experience as yet to judge. We have taken advantage of every opportunity in making subsidies to promote good land usage and have been at least partially successful.

Correcting past political errors is also not easily done. We have land use problems that are the direct result of our land disposal activity under the Homestead Act, railroad land grants, and Timber and Stone Act. Many sub-marginal farms and ranches, the selfish control of strategic water, the checkerboard ownership pattern of many national forests and ranges are all the result of unwise land disposal. We also have the problem of overtaxing low value lands which limits the opportunity to change poor land practices on them. However, this is a subject for special treatment and cannot be covered here.

Conservation on the scale that we now realize is necessary is without precedent so we are, in a sense, forced to "play by ear" in much of what we do. What we are trying to do is profit the most from each experience so that we won't have to experience living on an impoverished earth before we begin to develop a regard for nature. However, to be really successful we will have to mold a strong philosophy incorporating our experiences with nature with Christian principles. If we are successful in doing this, the problem of economic allocation of land will be taken care of in the ordinary course of events.

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A blade of grass grows and by so doing consumes components of the earth in its neighbourhood, thus changing it. In the course of its life the blade of grass captures and transforms into matter a part of the energy of the sun, subsequently dies and rots back into the earth, restoring the components it has used, and perhaps something more. Nothing has been lost and something even gained, some fraction of the radiant energy of the sun.

—EDWARD HYAMS, *Soil and Civilization*

Green Pastures Conserve Kentucky Soil

LYLE B. LEONARD

KENTUCKY, heretofore known best for her beautiful women and thoroughbred horses, is adding a third distinction—that of lush pastures, the result principally of a thorough-going program of pasture improvement launched almost three years ago and now bearing evidence of success.

A series of better pastures-better livestock meetings were recently concluded. Judging for district awards will be done during October. More people are working together for green pastures than ever before in the blue grass country's history. The Green Pastures Program cannot be assessed finally at this stage, but it appears to be headed for great success, which will include increased increased farm income.

Kentucky is in need of more agricultural income. Acreage controls prevent the tobacco crop from being expanded. Corn cannot be increased, either, because additional adaptable land is not available. But pastures can be increased significantly. It has been shown that most of the 12 million acres of cleared land in Kentucky is better adapted to pasture than any other crop. About three million of those acres are now virtually idle and a lot more produces only a fraction of its capability.

Pasture improvement, therefore, seems to be the best source for additional agricultural income. A good grass cover over the 12 million acres will also do much to stop erosion, which is a continuing problem.

The foregoing facts were known for many years to many people, but it was not until January, 1951, that definite concerned action was taken to develop a program. A broad outline was developed at a meeting between agricultural agencies and commercial representatives. The discussion leader was Mr. William C. Johnstone, extension agronomist.

Out of this meeting the Green Pastures Committee was formed, its members representing all groups in interest including federal and state agencies. Mr. B. W. Fortenberry, of the Kentucky Seed Improvement Association, was named chairman and Mr. Johnstone became state leader. County committees were shaped to the same pattern, with such variation as was necessary to provide for local situations.

The program has been furthered along four general principles:

1. Good use of all land (a) by growing cultivated crops only on land well adapted to profitable long-time production and with control of erosion; (b) by producing high yields of good quality hay and pasture on all other land where they are adaptable, and (c) by keeping all land not adapted to crops or pasture in forest.

2. Efficient treatment of all crops and pasture land (a) basing lime and fertilizer use on soil test and (b) conservation and best use of all manures and crop residues.

3. Long season production of good yields (a) by using adapted varieties of grasses and legumes in combination to keep pastures productive and (b) by using supplemented seedings of summer crops and winter grains as needed.

4. Good management and full utilization (a) by clipping weeds, rotation grazing, harvest of early summer surplus of hay, silage or seed crop and permitting accumulation of less palatable late summer growth (especially fescue) for early winter pasture and (b) by utilizing entire production in the most profitable manner, mostly by good livestock.

It is constantly emphasized that each farmer must

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The Spring Green Pasture Tour inspecting the farm of William Gilreath in McCreary County showing productive pasture lands, abundantly fertilized and well managed. These mountain lands originally were covered with brush and scrub timber. The soil was exceptionally thin.

progress from where he is. He must develop his own program after a careful evaluation of his land. The program should stem first from the best land, since results will be more satisfactory and there will be fewer disappointments. Also initial costs will be lower. When a definite level of improvement has been reached, then the farmer goes to his next best land, and so on until he finds himself working with the worst conditions.

The program is kept constantly before farmers through a number of devices. The state committee sponsors a spring tour, showing off the most successful pasture operations. Six farms in southeastern Kentucky were visited this year. Production methods and results were discussed on the land.

A number of newspapers published special editions with emphasis on Green Pastures. Radios were used extensively to drive home the general theme of pasture improvement and better agriculture.

For rewards, the state committee offers certificates for outstanding pasture farming and placques for county and district master pastureman citations. County committees make recommendations to the state groups and the latter makes the final selections. Scoring teams visit cooperating farms to evaluate results. Special citations are made to the county master pastureman and the district master pastureman. Sixteen district master pastureman awards are made annually. No farmer may be honored more than once.

Recognition also is given to county committees which do an especially good job. The award is such that it may be hung in the court house yard or some other conspicuous place. A loving cup will be given this year to the top county. Some counties have lesser awards, all of which makes for spreading interest among all segments of the farm population.

The people of Kentucky will live better because of the Green Pastures Program and the land will be improved through it for future generations to enjoy.

The Farm Fish-Pond

(*Continued from page* 176)

natural bodies of water such as lakes and streams is very ancient. Columella speaks of such stocking, not only with fish but with spawn (*ab ovo*). Apparently, however, the Romans did not stock their lakes and rivers with fresh water fish which normally would be indigenous to such waters but with salt water species, which though born in the sea had proved their adaptability to fresh water by penetrating some distance up streams. Columella claims perfect success for these experiments in the Ciminus, Sabatinus, Velinus, and Volsinius Rivers. Apparently the stocking of natural bodies of water declined and fell with the Roman Empire to be rediscovered, according to the Reverend C. David Badham, M.D., whose volume entitled "*Ancient and Modern Fish Tattle*," was published in London in 1854, by two Frenchmen, Gehin and Remy, more or less contemporarily with the publication of the book. These men whom Dr. Badham describes as Vosges fishermen, applied the procedure to various fresh water fish, as well as those frequenting both salt and fresh water.

The following stanza of a poem believed to have been written in England in 1750, explains somewhat the British theory of rotating land to crops of fish and grain:

> ***"When now for sixty months the scaly breed,***
> ***Has kept possession of the watery Mead,***
> ***Drain'd in its turn, it will reward the Swain,***
> ***For sixty months with more than promis'd Gain,***
> ***Thus may the Vale a new resemblance take,***
> ***And now a Field appear, and now a Lake:***
> ***Water and corn by turns possess the Plain,***
> ***And Ceres now, and now the Naiads reign."***

Succulents for Erosion Control

(*Continued from page* 186)

killed out when the temperature dropped below 25 degrees F. All disappeared during the succeeding spring and summer months. Apparently the scattered, few surviving plants of all species were unable to compete with the rank growth of annual weeds and grasses which invaded the plots.

In answer to the question—why not use succulents?—experience would indicate that one species, *Mesembryanthemum croceum*, and probably three others, *M. edule*, *M. roseum*, and *M. tenuifolium*, have some merit for erosion control use, if the following restrictions are observed:

1. Limit use to areas where temperatures lower than 25 degrees F. are rarely experienced.
2. Confine plantations to elevations not in excess of 3,500 feet.
3. Mass-plant to reduce deer and rabbit damage in wild-land areas as well as minimize annual weed and grass competition.
4. Limit planting for erosion control to slope gradients about 45 percent or less. Succulents may form a dense trailing cover on steep slopes yet be inadequate for slope stabilization because of insufficient root development.

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Pot Hole Erosion on the Western Part of Molokai Island—Territory of Hawaii

JOE W. KINGSBURY

SOIL EROSION BY WIND AND WATER is not difficult to understand. There are, however, differences in the water erosion pattern, the causes of which are not easily determined. Normal gully erosion is usually a result of sufficient water concentrating on sufficient gradient to detach and transport soil. This condition is more pronounced where soil is bare of vegetative cover or where cover is very sparse. Under these conditions on the range land of West Molokai, gully erosion is very pronounced. In addition to the conventional gully erosion pattern, in this area there is a condition which has been called pot hole erosion.

In order to better understand this erosion condition, it is essential to study the historical background of the vegetative cover and use of the soils of this area. At one time trees, shrubs and grass covered this area. Through the years, trees and brush have been removed and grass overgrazed, leaving the soil bare of vegetation or sparsely covered. In theory, under good vegetative cover, most of the rain that fell went into the soil, much of it going into deep percolation. Consequently, subsoil and substratum were kept moist at all times. As the vegetative cover was reduced, more of the rain that fell was lost from surface runoff instead of infiltrating into the soil. As the amount of water infiltrating into the soil decreased, the amount of water reaching the substratum and eventually the subsoil was decreased. First the substratum dried and cracked, and then the subsoil, and finally due to severe erosion the cracks appeared on the surface. These cracks formed good channels for rain water to enter the soil. Downward movement of water was so rapid that soil was carried down and where subsurface cracks were enlarged, the upper soil dropped, leaving sunken areas that formed perfect basins in which surface runoff water could collect. As a result considerable water collected in these basins and carried the soil down through the cracks, leaving holes of varying diameters and depths. Considerable area in the West Molokai range land has been ruined by gullies which have started as cracks and holes.

These holes may be any size from six inches in diameter to eight feet in diameter, and may vary in depth from slight depressions in the early stages to as deep as 14 feet in advanced stages. Usually the depth of the hole is determined by depth to firm or hard rock. The soil has blocky structure with long vertical or diagonal cracks giving the appearance of long columns. Peculiarly with this structure, the cohesive properties are weak, and soil is easily detached and transported. Dr. G. Donald Sherman took samples of the black subsoil shown in Figure 1. He states that the black soil is very high in montmorillonite clay which is not very common in Hawaii since most of the clay faction, of Hawaiian soils, is of kaolinitic origin. The following table shows the cation exchange capacity and exchangeable

Figure 1. Cracks are the beginning of the pot holes. They furnish openings in the soil through which water can run and wash the soil down enlarging the cracks to holes. This is also some of the dark soil high in montmorillonite clay.

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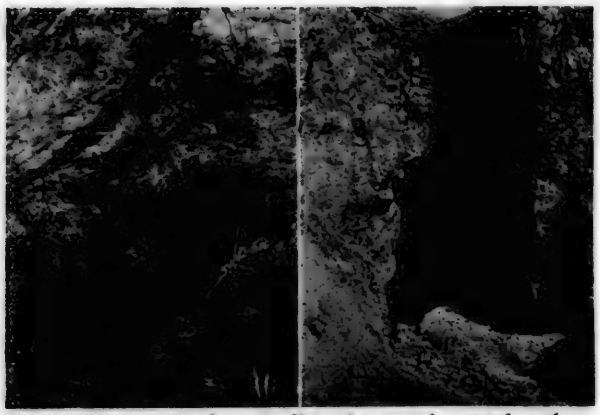

Figure 2. *Left.* Pot hole small in diameter but 14 feet deep. *Right.* Gully side showing undercutting from water which has run down through hole in photograph on left.

calcium and magnesium content of the soils in the badly eroded areas of Molokai.

Lab. No.	Cation Exchange Capacity	Ca. M.E./ 100 gm	Mg M.E./ 100 gm	Base Saturation Ca + Mg	pH
K1 Surface soil	13.99	5.22	4.59	70.12	6.6
K2 Subsoil	15.54	4.20	6.44	68.47	6.3
K3 Black subsoil	35.22	11.41	16.56	79.42	6.2
KIII Black subsoil	31.49	10.34	15.74	82.82	6.8

From observations and the tabulated results, it may be concluded that with increased magnesium content in the soil, cracks will be larger. However, the large cracks in the black subsoil are probably due to both the high magnesium and high montmorillonite clay content.

Pot hole erosion will continue to destroy land on West Molokai unless proper measures are adopted to prevent surface runoff of rainwater and increase the infiltration capacity of the soil. If these objectives are accomplished, depth of moisture penetration will be increased and soil cracking will be reduced. Proper measures for accomplishing these objectives will include a *long-time* program of range reseeding, total exclusion and deferred-rotation grazing over extensive areas.

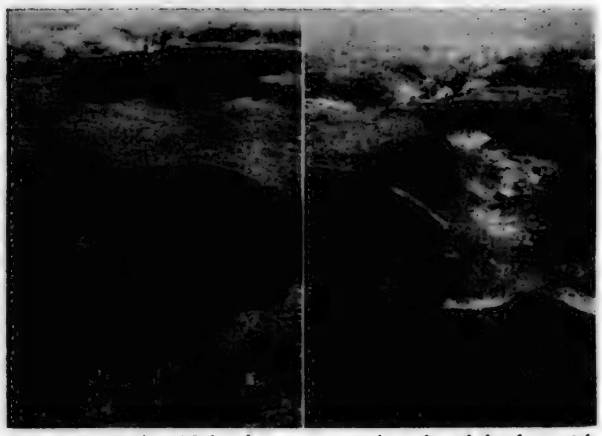

Figure 3. *Left.* Hole showing tunnel and soil bridge with gully in the background. Water has cut tunnel through soil from hole to gully—eventually hole will be part of the gully. *Right.* Closeup of gully shown in background of photograph on left. Note the series of semicircles which appear to be a series of pot holes that have been cut through and washed out forming the gully.

Grassland Farming

(*Continued from page* 170)

tions to find successful equipment for seeding the native grass seeds. Today, many commercial drills are available for planting all types of native grass seed. Furthermore, the farmers and ranchers themselves have learned the necessary techniques of seed production and commercial seedsmen have played their part. Today in this country we have a new group of farmers and ranchers who are experts in all forms of grass seed production.

Another important problem on the natural grasslands of the west is the invasion of worthless or near-worthless shrubby plants. These include mesquite, sagebrush, juniper, prickly pear, white-brush, numerous scrub oaks, McCartney rose, sand plum, and many others. Mesquite, for example, has infeseted some 55 million acres in the single State of Texas alone, and is a potential danger on range lands of five times that area.

These noxious plants rob the productive grasses of the moisture needed for their survival, greatly reduce the value of the land for grazing purposes, and frequently increase the erosion hazard. To a large extent, such woody species invaded the grassland as a direct result of improper use; but, once they become established, costly mechanical or chemical means are usually necessary to remove them. Newly-developed chemicals have been effective in destroying some of these plants, and control operations have been carried out on more than 30 million acres. Other species, however, have not been susceptible to the action of any chemicals now known, and practicable methods for their control are yet to be developed.

Undoubtedly, the most important field of inquiry still to be explored more fully is the ecology of our natural grasslands. Although many facts about grasslands and their relationships to soil and climate have been discovered, we are only beginning to sort out the more significant of these relationships. The recently developed "site classification" has been found exceedingly useful. It permits accurate determination of the extent to which range lands have deteriorated and, conversely, indicates the degree to which they can be improved. We now know that the possibilities for their improvement are enormous.

Book Reviews

THE CONSERVATION YEARBOOK—*1952, A Directory and Guide to Facts, Figures, and People in American Conservation. Edited by* ERLE KAUFFMAN. *Published by The Conservation Yearbook, 1740 K Street, N.W., Washington 6, D. C. 288 pages. Price $5.00.*

How many farms are included in the Winneshick County Soil Conservation District, in Iowa, where is its headquarters, and how does it compare in area and number of farms with the 2,338 soil conservation districts in continental United States? How much land will be irrigated by the Columbia Basin Reclamation Project when it is finished? From what nurseries can one purchase Douglas-fir planting stock? Who are the officials in charge of Conservation, . . Agriculture, . . Forestry, . . Wildlife in California?

Perhaps these are not the questions that plague you, but the chances are good that scarcely a day passes without the need of searching for answers to similar questions. Sooner or later you'll find the answer, tucked away in a file or in some book on a shelf. Or you will pick up the phone and get it from a friend. No one can store all such facts in their mind and few have an efficient file to turn to for reference. Yet the questions continually be-devil the life of anyone carrying on work in conservation. What a boon it is, then, to find so much authoritative information assembled between the covers of this new book—*The Conservation Yearbook—1952.*

The publisher's blurb describes this as a directory of nearly 400 conservation agencies, commissions, and other organizations of government, industry, citizens, and professional groups. With these are the names, titles, and addresses of more than 5,000 key men and women in resources planning and management.

The few who have been missed will probably lose no opportunity to assure being included in the next edition. And that brings up the importance of making this an annual publication, for constant change characterizes conservation as it does everything that lives.

Before I could complete this review I was using the book in the course of my regular work. Each time, as I look over the pages, I am amazed at the wealth of material which has been assembled. Unfortunately, all the subjects and headings are not included in the index. That is one of the improvements to be hoped for in the 1953 edition. Meanwhile, so much is here in so accessible a form, that having it at hand promises to save time and patience many times more valuable than the price of the book.

—HARRIS COLLINGWOOD, *Washington, D. C.*

RANGE MANAGEMENT: *Principles and Practices. By* A. W. SAMPSON. *John Wiley & Sons, New York. 570 pp., ill. $7.50.*

A book on range management by Arthur W. Sampson is assured of an interested reading by a wide audience. The author has had a widely recognized hand in the formation of the science and art about which he writes. Workers in this field who do not know him personally are familiar with his name and ideas through his publications. All will be interested to see the latest expression of his viewpoints and a summary of his broad knowledge of the subject.

The book is an outgrowth of many years of research, teaching, and active leadership in the field of range resources and management. By his own account, the chapters have been formed in response to the needs of his experience with students and administrators, and revised in the light of changing ideas. It is not a work produced at one sitting, but is the culmination of a long process of evolution.

The result is a comprehensive survey of the whole field of grazing land management. It considers the use and care of the land itself, with primary emphasis on forage resources, but with due consideration of the grazing animals, wildlife, forests, and other related elements. Throughout, it seeks to relate these practical matters to the basic sciences upon which sound practices must be based. The book is unrivaled in the scope of the topics discussed.

The subject matter is treated in four parts: 1, "*Range Management in Perspective*"; 2, "*Native Range Forage Plants*"; 3, "*Improvement and Management of Range and Stock*"; and 4, "*Protection of Range Resources and Range Livestock.*"

The first part defines general concepts of range management and relates them to the basic sciences on which they are founded, particularly plant physiology and ecology. Range management is defined as "*the science and art of procuring maximum sustained use of the forage crop without jeopardy to other resources or uses of the land.*"

The author is particularly at home in the discussion of the relation of range management to ecology, since this is a field in which he pioneered. His early recognition of the relation of the stages of secondary plant succession to grazing effects laid the foundation for modern ecological concepts of range condition. He also led in developing the use of "plant indicators" as tools in range

analysis. These topics are naturally prominent in this discussion.

The section on range forage plants deals exclusively with species of the far west. The material serves principally to illustrate a taxonomic treatment of the subject. Though no doubt useful as a teaching tool, this section will have little value outside the classrooms of a few western colleges.

The meat of the book is in part 3, "Improvement and Management of Range and Stock." Here again, the text deals largely with problems of the mountains, basins, and deserts of the far west. The extensive and highly productive native grazing lands of the prairies and plains of the Mississippi basin, and the widespread forest ranges of the humid southeast are scarcely more than mentioned in passing. The distinctive problems and management practices of these important regions are not adequately treated.

In this section first consideration is given to such practices as artificial reseeding, irrigated pastures, burning, and control of noxious plants, rather than to range improvement through grazing management. When this phase of the subject is developed in discussions of range condition, utilization, and trend, it is done largely in terms of the standards and procedures long used in the government administration of public lands in the west, with little attention to newer approaches and simplified techniques finding widespread favor in work with private ranch operators and stock farmers.

Part 4, on *"Protection of Land Resources and Range Livestock,"* includes chapters on forests, poisonous plants, wildlife, and soil erosion.

The chapter on soil erosion, though brief, is rewarding. Although the concepts of erosion processes are drawn from the earlier works in the field (only nine out of 50 references are dated within the past ten years), the author gives his own individual emphasis to the subject matter. This is particularly interesting in his discussion of the role of vegetation in erosion control. Primary importance is given to the functions of plants in conditioning the soil through providing organic matter and furnishing food for the teeming micro-organisms and earth-dwelling animals which are a vital link in the ecological system. The soil-shielding properties of vegetation are also recognized.

The book concludes with a brief sketch of the agencies concerned with the administration of public grazing lands.

Despite its regional limitations, the book contributes a comprehensive organized statement of the principles of range management. It will be especially useful as a teaching outline on the college level, if augmented by local illustrative material and the latest publications on each topic.

—BEN OSBORN, *San Angelo, Texas.*

BOB WHITE. *By* R. W. ESCHMEYER. *Fisherman Press, Inc., Oxford, Ohio. 1952. 50 pages. Illustrated. 50 cents.*

CHARLIE COTTONTAIL. *By* R. W. ESCHMEYER. *Fisherman Press, Inc., Oxford, Ohio. Illustrated. 50 cents.*

This very excellent book is written for grade school children. It personalizes the life of a quail named "Bob" beginning with his hatching and ending with his death from gunshot, although this event is several pages from the end of the story.

The story is pleasant, easy reading and very suitable for its audience. The life history information is accurate and is presented with constant emphasis on the relations of the quail to its environment. However, this reviewer is primarily concerned with the conservation impact of the book.

Bob is born and lives his whole life on the Benson farm because of the *". . . shrubs along the fences . . .", ". . . thickets in the middle of several of the fields where there were old gullies . . .", ". . . patches of weeds . . ."* at field ends, and so on. This is in contrast to nearby farms that have no such cover because they clean farmed and where consequently the quail can not live.

The story might have been much improved by describing the good quail habitat on the Benson farm resulting from the use of sound conservation practices; also the lack of it on the clean farms as an exploitive system where not only wildlife is lacking but agricultural stability as well.

The last part of the story concerns the Benson boy's decision to return to the farm following college rather than accepting a lucrative job in the city. Its relation to quail is that his love of the bobwhite proved the turning point in his determination to come back to the good life (even though *"The quail never brought us any money . . ."*) rather than live the nervous struggle of a city business man. His father then recounts his own story of returning to his boyhood farm after a successful city business life which, however, broke his health. *"The quail taught us that peace and contentment are more important than money. . . ."*

A story for grade school children about cottontail rabbits on the "Jackson" farm and what Bob Jackson and his father did to favor them. The thread of the tale concerns "Charlie," an individual rabbit, beginning with the time of his naked, blind birth in a hayfield nest. His habits of eating, seeking shelter, escaping from enemies are recounted. The ecology of the cottontail is woven into the theme and the desirability of conservation practices useful to the species.

A bit of game management is included by having Bob

cooperate with "the game man" in a live trapping and tagging venture. By proportioning the rabbits tagged: "X" as tagged rabbits shot: total rabbits shot, the total rabbit population of the farm is figured.

—FRANK C. EDMINSTER, *Upper Darby, Penn.*

EDITOR'S NOTE: *The two children's books reviewed by Mr. Edminster are from Dr. R. W. Eschmeyer's True-to-Life stories. Others in this series are "Billy Bass," "Tommy Trout," "Freddy Fox Squirrel" and "Bobby Bluegill." The books are important to the future of America's wildlife. Others are to follow in 1953.*

Important Grassland Plants of Kenya. BY D. C. EDWARDS *and* A. V. BOGDAN. *Sir Isaac Pitman & Sons, Ltd., London; 124 Pages, Illustrated. 1951.*

This book is divided into two parts: The Natural Grasslands and The Main Groups of Plants in Natural Pastures. A Glossary of Technical Terms used in the text is also included.

The authors have grouped the natural grasslands under five heads, each clearly defined and shown on a vegetation map of Kenya. In addition, numerous plants are described along with appropriate drawings for identification purposes. These plants include grasses, legumes, sedges and other plants.

Management and Conservation of Vegetation in Africa. A SYMPOSIUM. *Bulletin 41 Commonwealth Bureau of Pastures & Field Crops, Penglais, Aberystwyth, Wales. 97 pages. Illustrated. 1951.*

Here is an excellent Symposium by scientists working in the British Commonwealth countries of Africa. It emphasizes the fact, that if periodic food shortages are to be avoided, soil conservation through proper management of vegetation is a major necessity. Shifting cultivation and the misuse of fire, point out the several authors, are becoming more alarming as the human population increases. Because of this, the introduction of improved agricultural practices is an imperative need if the well-being of the peoples of Africa is to be safeguarded.

The book covers the subject more from the standpoint of vegetation surveys and the mapping and description of the different broad types of vegetal cover, rather than land management.

New Conservation Film

Green Promise. *Color with Sound. Running length 30 minutes. New Holland Machine Company, New Holland, Penn.*

This is the story of a new and more profitable way of agriculture—grassland farming. Told by real farmers . . . and the men of science and education who helped rediscover the value of grass as a crop. The film emphasizes the four great benefits of grassland farming—(1) protects the land, (2) increases yields of rotated crops, (3) the best livestock feed and (4) easily mechanized.

Geography in the Twentieth Century. *Edited by* GRIFFITH TAYLOR. *Philosophical Library, New York, 1951. Pp. 630, figs. 56. Price $8.75.*

Seven Americans, six Canadians, five Englishmen, and two Slavs have written the 26 chapters in this very interesting and important book. The first six chapters have to do with the evolution of geography and its philosophical basis. The next ten chapters deal with environmental factors. The remainder of the book is concerned with such matters as racial and urban geography, sociological, aviation, empire, and political aspects of geography, and the field of the geographical society. The environmental factors are of special interest to soil-plant scientists. The following chapters merit special mention: Soils and Their Geographical Significance, by D. F. Putnam; Settlement by the Modern Pioneer, by Isaiah Bowman: Geography and the Tropics; by Karl J. Pelzer; and Land-Use Surveys, by L. Dudley Stamp. The book contains a number of very interesting maps. A concise glossary of geographical terms is appended. This book merits careful reading by all those who think in terms of internationalism.

Some New Publications

Soil and Civilization. *By* EDWARD HYAMS. *Published by Thames and Hudson, New York. 312 pages. $4.50.*

The Soil: Our Greatest Treasure. *By* E. GUILLAN HOPPER. *Natural Resources Board of Southern Rhodesia. Press and Commercial Productions, Salisbury. 32 pages, illustrated.*

Soil and Water Conservation—*Merit Badge Series. By* BERNHARD A. ROTH. *Boy Scouts of America, 2 Park Avenue, N. Y. 96 pages. 25 cents.*

Guide to Agriculture, U.S.A. *By* ARTHUR F. RAPER *and* MARTHA J. RAPER. *Agriculture Information Bulletin No. 30, U.S.D.A., Washington, D. C. 84 pages, illustrated. 50 cents.*

Management of Grasslands in the Northeastern States. *By* V. G. SPRAGUE, R. R. ROBINSON and R. J. GARBER. *Bulletin 554, Agricultural Experiment Station and Regional Pasture Laboratory, U.S.D.A., State College, Penna.*

FIELD NOTES AND COMMENTS

Two SCSA Members on Special Conservation Mission in Jamaica

Dr. John Gordon Steele of the United States Soil Conservation Service and a member of the SCSA has accepted a year's assignment as soils adviser to the Government of Jamaica on behalf of the Food and Agriculture Organization (FAO). Dr. Steele will be on leave of absence from his SCS job in Washington, D. C., to carry out his work in Jamaica.

Steele will work with Theodore Hebel of the Soil Conservation Service, also a member of the SCSA, as a two-man team, Steele as a soil scientist and Hebel as a conservation specialist. Hebel is already at work in Jamaica. They will choose some work areas there for demonstrations of good soil conservation practices. As part of the demonstrations, they will map the land conditions on some farms and develop soil conservation programs for these farms. The Government of Jamaica has asked FAO for help in developing a soil conservation program as a part of FAO's expanded technical assistance program.

American Forestry Association Holds Annual Meeting in North Carolina

Asheville, North Carolina, in the heart of the land often described as the cradle of American forestry, will be host to The American Forestry Association's 77th annual meeting, October 12-15. The meeting will be held in conjunction with that of the North Carolina Forestry Association and the theme of the joint gathering will be "Forests and Water." The meeting has been timed to take full advantage of the fall mountain coloring and reservations are now being accepted at the Battery Park Hotel, headquarters for activities.

In addition to timely talks and panel discussion on important conservation issues there will be several outstanding field trips, including the Coweeta Hydrologic Laboratory and the Bent Creek Experimental Forest, Biltmore Plantations and others.

Rules and Advisory Committee Formed For National Land Judging Contest

At the request of the sponsors of the National Land Judging Contest, the Oklahoma Publishing Company, a group met at Oklahoma A. & M. College, Stillwater, to adapt the score card and contest regulations for wider use. This committee will be advisory to the sponsors for the Second National Land Judging Contest to be held in Oklahoma in early May 1953. The exact dates have not yet been set. Land judging score cards in use in the states were studied along with suggestions from many people for modifications.

It is not intended that the new score card will supplant those in use in the states nor is it designed for educational use. It is a score card for use in the National Contest and the assumption is made that the participant has had considerable training and experience in land judging. Contestants will have an opportunity to go through a land appreciation school conducted in connection with the Contest.

The sponsors have announced that a division will be set up for college students in the 1953 contest. Other judging divisions will be for vocational agriculture students, 4-H club members and for adults.

There is a greatly increased interest in land judging. It is estimated that some land judging is being done in half of the states. Letters have been received by the Oklahoma people from persons in 40 states and eight countries requesting information about land judging.

Edd Roberts, Extension Soil Conservationist of Oklahoma, will be chairman of the Rules and Advisory Committee for the Second National Land Judging Contest in 1953. Other members of the Committee are:

H. F. Murphy, Head of Agronomy Dept., Oklahoma A. & M. College, Stillwater, Oklahoma; W. Elmo Bauman, Soil Conservation Service, Agronomy Dept., Oklahoma A. & M. College, Stillwater, Oklahoma; Harold E. Grogger, State Soil Scientist, Soil Conservation Service, Columbia, Missouri; Louis E. Derr, State Soil Scientist, Soil Conservation Service, Oklahoma A. & M. College, Stillwater, Oklahoma; P. G. Haines, Extension Service, Texas A. & M. College, College Station, Texas; Fenton Gray, Asst. Professor in Soils, Oklahoma A. & M. College, Stillwater, Oklahoma; Harley A. Daniel, Soil Conservation Research, Guthrie, Oklahoma; W. R. Tascher, Extension Soil Conservationist, U. S. Department of Agriculture, Washington, D. C.; Cleo A. Collins, District Supervisor, Vocational Agriculture, Stillwater, Oklahoma; and Sandy Saunders, WKY, WKY-TV, Oklahoma City, Oklahoma.

North American Wildlife Conference Scheduled for Washington, D. C., in 1953

The effects of increasing demands of growing populations on limited supplies of natural resources will be emphasized in the program of the 18th North American Wildlife Conference which will be held in Washington, D. C., next March under the sponsorship of the Wildlife Management Institute. Attention will be focused on the most urgent domestic problems facing North America today.

No phase of conservation and restoration of natural resources has been omitted from the broad program, which will include discussions by international leaders

and qualified experts on subjects ranging from the basic resources of soil and water to the management of their ultimate living products. Wise use of all resources will be stressed in the nine sessions of the three-day meeting. Never before in history has a greater need existed for a definite evaluation of our present and future policies toward these natural assets.

The Conference program is being formulated around the central theme: ***"Natural Resources and Human Needs."***

About 60 papers will be selected for presentation in the scheduled sessions that will be held on March 9, 10, and 11, 1953, in the Washington Statler, one of the country's most modern hotels. All papers and the recorded discussions from the floor will be published by the Institute, as formerly, in the printed Transactions of the Conference.

SCSA Member Active in Brazil

DEAR SIR:

While on a field trip last week through the coffee area of Northern Paraná, I observed an excellent piece of soil conservation work being done.

Upon inquiry I found that it was being supervised by Paulo Ribeiro Carneiro. He is a member of your Association, and learned the fundamentals of soil conservation at Ipanema Fazenda. Ipanema is a school for training county agents in the use of the mechanical equipment. In connection with that instruction they give courses in engineering, extension service, soil conservation, and irrigation. The school was started some five years ago by the Brazilian Ministry of Agriculture and the assistance of American technicians furnished by the U. S. Department of Agriculture.

There is a great interest in soil conservation in this country, and there are innumerable demonstrations similar to that shown in the accompanying photograph.

—W. G. LODWICK, *U. S. Agricultural Advisor, Joint Brazil-U. S. Economic Development Commission*

Conservation practices in the coffee area of Northern Paraná, Brazil.

Editorial in WORLD CROPS Praises SCSA Brochure "Down the River"

The Soil Conservation Society of America appears to be an extremely active body. Described as a professional organization dedicated to the science and application of soil and water conservation, its aims may be said to be to further the efforts of the administration to secure proper and efficient land use throughout the territory of the U.S.A.

Recently the Society has produced an attractive and informative illustrated leaflet under the title which heads this paragraph, which in simple non-technical language sets out the importance of soil and water conservation and the dangers and disasters which can arise as the result of land misuse. Incidentally, it stresses the enormous losses of soil which take place whenever rivers come down in flood, a point which is underlined by the recent disastrous floodings in the Missouri Valley.

The brochure in question is directed not so much to dwellers in the country-side as to the urban populations. It is, in fact, announced as the aim of the Society to place a copy of the brochure in every urban home throughout the American nation. This is a proposition of somewhat breath-taking proportions; nevertheless, none can gainsay the force of the argument that the bulk of the urban populations—the men who work in factories and their wives and children—have not been alerted to the fact that conservation of natural resources and efficient production on the farms is in the long run every bit as important to them as to the farmers themselves. One cannot but feel that this move towards awakening urban populations to the importance of rural production is one that might with advantage be copied in many other countries.

Conservation Up To Man

Teach us, O Lord, it's not more rain we need
But less carelessness, and less haste;
Help us to realize that our water shortage
Is primarily too much waste.
That nature amply seeds the clouds
In accordance with a Divine plan.
Teach us, O Lord, to save the rain,
It's conservation is up to man.

—GEORGE S. TUNNICLIFFE,
West Trenton, New Jersey.

These lines were written by Mr. Tunnicliffe during the time when the water supply reservoirs of New York City were making headlines.—EDITOR.

"Grass is the forgiveness of nature,—her constant benediction . . . streets abandoned by traffic become grass-grown rural lanes . . . harvests perish, flowers vanish, but grass is immortal.

"One grass differs from another in glory. One is vulgar, and another patrician—Some varieties are useful. Some are beautiful. Others combine utility and ornament . . ."

—*From Kansas Magazine, Vol. 2: 270-277; 1872. "Bluegrass" by John Ingalls.*

You are Invited to Attend the

SEVENTH ANNUAL MEETING

of the

SOIL CONSERVATION SOCIETY OF AMERICA

HOTEL STATLER, BUFFALO, NEW YORK, OCTOBER 23, 24, 25

Make plans now to attend the annual meeting of your professional society. This meeting will have many International aspects. An interesting and informative program has been arranged, including a tour of Niagara Falls for all who are registered. Special events of interest to the ladies have also been arranged.

Here are some of the Program Highlights

Thursday, October 23

Conservation Advances in Canada—E. S. Hopkins, Director Experimental Farms Services, Ottawa, Canada.

Organic Improvements: New Developments in Cropping Practices—Dr. M. B. Russell, Head Agronomy Department, University of Illinois, College of Agriculture, Urbana, Illinois.

Physical Improvement: The Soil Additives—Dr. R. W. Pearson, Senior Soil Scientist, U. S. Bureau of Plant Industry, Alabama Agriculture Experiment Station, Auburn, Alabama.

Chemical Improvements: Fertilizers in a Soil Conservation Program—Dr. Emil Truog, Professor of Soil Fertility, College of Agriculture, University of Wisconsin, Madison, Wisconsin.

What Ground Water Means to Rural Communities and the Farmer—Gerald E. Eddy, Director, Department of Conservation, State of Michigan, Lansing, Michigan.

Friday, October 24

Conservation and the Work of the Farm Equipment Industry, the Dealers, and the Districts—Phil H. Noland, Chairman of Soil and Water Conservation Committee, Farm Equipment Institute, Louisville, Kentucky.

Making Full Use of Grasses in Livestock Production—Jerry B. Thorne, Vice President, Wilson and Company, Inc., Chicago, Illinois.

Forestry as a Part of the Farm Enterprise—Dr. W. S. Swingler, Assistant Chief for State and Private Forestry, U. S. Forest Service, Washington, D. C.

Wildlife and the Business of Farming—Durward Allen, U. S. Fish and Wildlife Service, Washington, D. C.

Soil Conservation and Farm Management—Sherman E. Johnson, Bureau of Agricultural Economics, U. S. Department of Agriculture, Washington, D. C.

Saturday, October 25

Land Classification—Committee Chairman, S. W. Cosby, Regional Soil Scientist, SCS, Portland, Oregon.

Crimson Clover Die-Out—Committee Chairman, T. C. Maurer, SCS, Spartanburg, South Carolina.

Watershed Management—Committee Chairman, Orville Chinn, Diretcor Division of Flood Control and Water Usage, Department of Conservation, Frankfort, Kentucky.

Wetland Management—Committee Chairman, Frank C. Edminster, Soil Conservation Service, Upper Darby, Pennsylvania.

Technical Standards—Committee Chairman, Alfred M. Hedge, Soil Conservation Service, Washington, D. C.

The Meaning of Soil Conservation—Committee Chairman, William R. Van Dersal, Soil Conservation Service, Portland, Oregon.

World Population Trends, Food Needs and Supplies and Conservation—Msgr. L. G. Ligutti, Des Moines, Iowa.

Food and Agriculture Organization of the United Nations and Its Relation to Soil Conservation—Miss Florence Reynolds, FAO, Washington, D. C.

Achieving Conservation Objectives Through the Ontario Conservation Authorities Act for Doing the Job on a Watershed Basis—A. H. Richardson, Chief Conservation Engineer, Ontario Department of Planning and Development, Toronto, Ontario

SEND YOUR RESERVATION DIRECT TO THE STATLER HOTEL BUFFALO, NEW YORK

You owe it to yourself and your profession to attend this annual meeting!

Black and green "rainbows" pay a fortune to farmers

Many farmers have found the legendary pot of gold since they started plowing "rainbows" in their fields. Farming on the contour, and plowing back lush, green cover crops have turned thousands of weary farms into profitable producers. These and other recommended soil conservation practices enable farmers to enjoy a larger cash income and build the future productivity of their farms at the same time.

Labor-saving McCormick Farmall tractors and *regular* McCormick farm equipment make most soil-saving practices both profitable and practical. With this dependable power equipment, farmers can create their own black and green "rainbows" that not only *promise* a better future, *but pay for it!*

INTERNATIONAL HARVESTER

International Harvester builds equipment that pays for itself in use—McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Crawler Tractors and Power Units . . . Refrigerators and Freezers—General Office, Chicago 1, Illinois

Sensible Tools For Practical Conservation

It's one thing to build good soil-conserving structures, and to initiate sound conservation practices. It's another thing to *maintain* them on a practical basis . . . to keep them working properly.

We've all seen terraces, grassed waterways, and other structures carefully designed to save soil, doing more harm than good because they were allowed to break down at vital points during critical seasons. The lack of sensible tools to maintain such soil and water-holding structures is often the Achilles heel of conservation practices.

The NEW IDEA-Horn Hydraulic Loader and Dozer, with easy-on-and-off working attachments, is the type of big capacity, versatile tool that makes it possible for the farmer easily to do a good job of conservation *within the framework of his regular farming routine.* Design and quality of this tool is outstanding . . . which is expected of any piece of farm equipment bearing the name "NEW IDEA."

Dirt Bucket (above) and Dozer Blade (below). Two of the quickly interchangeable attachments for the New Idea-Horn hydraulic loader.

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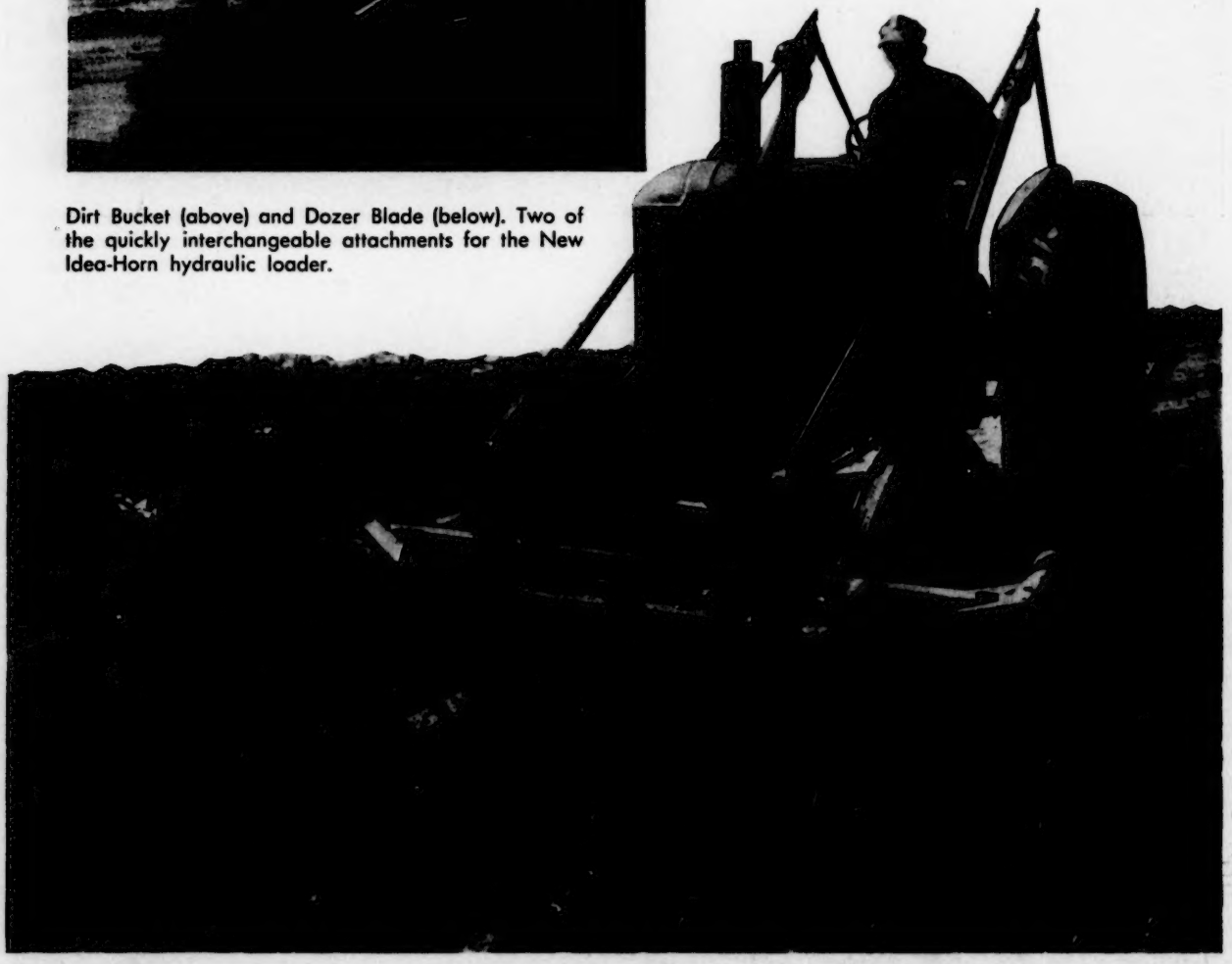
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